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A Revision of the North American Eurhynchia.

By A. J. GROUT.

A careful study of the North American species ordinarily referred to the genus *Eurhynchium*, so far as represented in the herbaria of Columbia University, the University of Wisconsin, the National Museum, the collections of Prof. John Macoun, and some private herbaria, together with selected specimens from the herbarium of Harvard University, have convinced me that the relationship of these species will be better represented by referring them to more than one genus.

I take pleasure in acknowledging my obligations to Prof. L. M. Underwood, Mr. F. V. Coville, Prof. C. R. Barnes, Prof. John Macoun, and Dr. B. L. Robinson for specimens loaned. I am also greatly indebted to Mr. H. N. Dixon for valuable notes on *E. praelongum*, *E. hians*, and *E. Stokesii*, and for a large number of English specimens of the same; also to Dr. G. N. Best and M. Jules Cardot for various notes and specimens. Mrs. E. G. Britton and Mr. M. A. Howe have frequently assisted me by valuable suggestions, and by looking up references and revising manuscript.

Leaves papillose by the thickened angles of the cell walls; leaf cells 8–15 : 1.
Bryhnia.

Leaves very slightly or not at all papillose; leaf cells 4–6 : 1.

Leaves very concave, cochleariform, abruptly long filiform-acuminate.
Cirriphyllum.

Leaves plane or slightly concave, not cochleariform; branch leaves acute to acuminate. *Eurhynchium.*

[Issued 12 May.]

CIRRIPHYLLUM gen. nov.

Gametophyte very robust, glossy, growing on earth and rocks, occasionally on roots of trees; stems possessing a well differentiated central strand, prostrate or creeping, irregularly or subpinnately branching, branches julaceous, terete-foliate. Leaves imbricate, *very concave, spoon-shaped, rounded and often cucullate at apex, abruptly drawn out into a long filiform acumination*, costate to the middle or beyond; median leaf-cells linear, 10–15 : 1; basal broader and shorter; alar often quadrate. *Sporophyte* as in *Brachythecium* except that the operculum is usually long-rostrate.

The plants referred to this genus certainly have no closer genetic relationship with those retained to represent *Eurhynchium* than with several other genera. The rostrate operculum is the only character which would link the two in one genus. Lindberg transferred the European representatives of this genus to the division *Rhynchostegium* of the genus *Hypnum*, while Kindberg places them all in *Brachythecium*. The gametophyte characters of several species are certainly more like *Brachythecium* than *Eurhynchium*. The resemblance between *C. Tommasinii* and *Brachythecium albicans* is certainly very striking, and robust forms of the latter have been taken for the former. Consequently it seems far more satisfactory to constitute the following species a separate genus, far better characterized than many of the allied genera, also more distinct and more homogeneous. Some of the species here referred to *Cirriphyllum* have been referred to *Myurium*, but the fact that the leaves of the species upon which the genus was founded, *M. hebridarium* Schimp, are ecostate seems to be sufficient proof that it is not congeneric with any of the following species.

Leaves with a very long filiform acumination.
- Apex of branch leaves strongly cucullate at base of the acumination.
  - High alpine mosses growing on stones; costa of stem leaves very short. 1. *C. cirrosum.*
  - Lowland mosses growing on the ground and roots of trees; costa of stem leaves extending ⅔ their length. 3. *C. piliferum.*
- Apex of branch leaves not cucullate at base of acumination.
  - Acumination 0.3–0.4 mm. long; median leaf-cells 3–4 : 1. 2. *C. Brandegei.*
  - Acumination 0.5–0.8 mm. long; median leaf-cells 8–12 : 1. 1a. *C. cirrosum Coloradense.*

Leaves shorter acuminate, apex twisted. 4. *C. Boscii.*

1. CIRRIPHYLLUM CIRROSUM (Schwaegr).

Hypnum cirrosum Schwaegr. Schulte's Reise auf d. Glockner, 365. 1804.

Brachythecium cirrosum Schimp. Syn. Ed. 1: 696. 1860.

Eurhynchium Vaucheri var. *julaceum* Br. & Sch. Bryol. Eur. fasc. 57–67, *pl. 530.* 1854.

Myurium (?) *Herjedalicum* Schimp. Syn. Musc. 696. 1860 (*fide Juratzka*).

Eurhynchium cirrosum Husnot, Musc. Gall. 338. 1893.

Gametophyte in bright glossy yellow-green mats; primary stems creeping, irregularly branching; branches 5–10 mm. long, julaceous; branch leaves appressed-imbricate, decurrent, oblong-ovate, not including acumination 1.3 × 0.65 mm., entire or serrulate above, abruptly narrowed to a filiform acumination which is serrulate to nearly entire, 0.5 mm. long, concave and spoon-shaped, cucullate at base of acumination; margins somewhat reflexed below; costa short, extending from ⅓–½ length of leaf, sometimes divided or branching; median cells 10–12 : 1; alar quadrate to hexagonal, indistinct; stem leaves ovate, body of leaf 1.8–2.4 mm., acumination 0.6–1 mm. long, area of quadrate-hexagonal alar cells much larger; costa very short, median leaf-cells somewhat shorter: dioicous; perichaetial leaves ecostate, serrate at apex, abruptly narrowed into a long filiform squarrose serrate acumination. *Sporophyte* 15 mm. high; seta twisted to the right, rough with blunt papillae; capsule ovoid, unsymmetric, horizontal, with operculum 2 mm. long, 2–1, chestnut-brown, not contracted under the mouth when dry; operculum sharply conical, not rostrate; annulus * not highly differentiated, segments split between the articulations; cilia 2, strongly nodose; spores 18–20 μ, finely roughened.

Sporophyte not yet reported from America. Description of sporophyte adapted from Limpricht, Rab. Krypt. Fl. 4^3: 183. 1897.

Growing on rocks in mountains. Colorado, Brandegee, Wolf & Rothrock; Pike's Peak, Mrs. S. B. Clark, J. M. Holzinger.

Type locality, European.

ILLUSTRATIONS. Br. & Sch. l. c; Husnot, Musc. Gall. *pl. 97;* Limpricht, Rab. Krypt. Fl. 4^3 *f. 386*; Dixon & Jameson Handb. Brit. Mosses, *pl. 53, f. G.*

* Mrs. Britton, March, 1897, in specimens collected in Algau by Molendo (Herb. Jaeger), found the annulus to consist of 3 rows of very irregular and persistent cells.

Our American specimens are less robust and shorter stemmed than most of the European material at hand and the stems are not stoloniferous or the branches flagelliform as is usually the case with European specimens, yet some European plants agree almost exactly with the American plant and the two are almost certainly the same species. *C. cirrosum* is a very variable and poorly understood plant even in Europe.

1a. CIRRIPHYLLUM CIRROSUM COLORADENSE (Aust.).

Hypnum Coloradense Aust. Bot. Gaz. **2**: 111. 1877.

Gametophyte robust; stems 3–5 cm. long, erect or at length prostrate, sparingly branched; leaves loosely imbricate, oblong-ovate, 2–2.2 × 0.9 mm. without the acumination, which is 0.5–0.8 mm. long, nearly entire, abruptly long filiform acuminate but not at all cucullate, much less concave than in the typical form, somewhat plicate.

Type locality, Alma, Park Co., Colorado, Miss H. J. Biddlecome. Type in the herbarium of Columbia University.

Distinguished by the stout, sparingly branched stems and loosely imbricate leaves which are not cucullate at apex. It does not correspond with any of the European varieties mentioned by Limpricht so far as can be determined from the material at hand. It is clear that Austin did not know the true *cirrosum* for there is a specimen of it from Colorado labelled in Austin's handwriting, "*Hypnum Coloradense var. dimidio minus, sericeo-aureo viride, caule subjulaceo tereti.*"

2. CIRRIPHYLLUM BRANDEGEI (Aust.).

Hypnum Brandegei Aust. Bot. Gaz. **3**: 31. 1878.

Gametophyte densely caespitose, yellow-green; stems erect, 3–4 cm. high, nearly simple, terete-foliate, obtuse; leaves loosely appressed-imbricate, not decurrent, ovate, abruptly subulate-acuminate to filiform-acuminate, 2 × 0.9 mm., acumination 0.3–0.4 mm. long, entire, concave, plicate; margins plane; costa reaching the middle of leaf, sometimes forking; median cells oblong-linear, 25–30 × 9 μ; basal cells shorter and broader, alar enlarged-quadrate. *Sporophyte* unknown.

Type locality, Colorado, Brandegee. Type in the Columbia University Herbarium.

Easily distinguished from *C. cirrosum* by its caespitose habit, short entire acumen and much looser areolation.

3. CIRRIPHYLLUM PILIFERUM (Schreb.).

Hypnum piliferum Schreb, Spicil. Flor. Lips. 91. 1771.

Eurhynchium piliferum Br. & Sch. Bryol. Eur. fasc. 57–61, *pl. 531.* 1854.

Rhynchostegium piliferum De Not. Cronaca, **2**: 11. 1867.

Brachythecium piliferum Kindb. Can. Rec. Sci. 1894: 73. 1894.

Gametophyte in wide loose mats, glossy, bright yellowish-green; stems long, sometimes reaching 20 cm., creeping, irregularly divided, pinnately branching, sparingly radiculose; branches rather distant, 10–15 mm. long, terete-foliate; branch leaves loosely erect, imbricate, decurrent, ovate, very concave and spoon-shaped, the rounded apex abruptly narrowed into a long, filiform acumination; 1.2 × 0.8 mm., smaller near ends of branches; acumination one-half length of the body of leaf, apex cucullate, margins strongly serrate, more nearly or quite entire at base, costa fully two-thirds length of body of leaf; median leaf-cells linear, 10–15 × 1; alar cells abruptly enlarged and inflated; stem leaves larger and more broadly ovate, 1.5–2 × 1 mm. (2–2.5 × 1–1.2 mm. according to Limpricht), enlarged and inflated alar cells more numerous: dioicous; male plants somewhat smaller; perigonial leaves ovate, long-acuminate, ecostate; perichaetium sheathing, the leaves ovate, somewhat abruptly narrowed to a very long slender erect-spreading acumination, somewhat serrulate, ecostate or some of the inner slightly costate. *Sporophyte* 2–3 cm. high; seta dark red-brown, twisted to the right, very rough with low blunt papillae; capsule red-brown, inclined to horizontal, oblong-ovoid, arcuate; urn 2.5 mm. long, 2–3 : 1; operculum nearly as long as the urn, long rostrate from a conic base; annulus of at least two rows of cells, detachable; teeth of peristome very slender pointed, very strongly papillose-roughened above; segments nearly or quite as long as the teeth, slender, split between the articulations; cilia 2 or 3, long and very slender, nodose to subappendiculate; spores smooth, 12–16 μ, maturing in winter or early spring; sporophyte rare.

Type locality, European.

On the ground and base of trees in woods and shady meadows, most frequently on steep springy shaded banks of rivulets, often closely interwoven with other mosses; New Brunswick, J. Moser New Hampshire, James; Vermont, Frost, Carey; New York, E. C. Howe, Peck; New Jersey, Austin; Pennsylvania, James, D. A. Burnett; Ohio, Sullivant; Washington, D. C., Oldberg.

ILLUSTRATIONS. Br. & Sch. l. c.; Hedw. Musc. Frond. **4**: 35, *pl. 14*, 1794: Husnot, Musc. Gall. *pl. 97*; Dixon & Jam. Handb. Brit. Mosses, *pl. 53, f. K.*

EXSICCATI. Sulliv. & Lesq. Musc. Bor. Am. (Ed. 1) 290[b], (Ed. 2) 492. Austin, Musc. Appal. 336.

Infrequent or else overlooked because of its sterility.

Our American plant is much less robust than the European.

Cirriphyllum Tommasinii (Sendt.) (*Hypnum Vaucheri* Schimp. not Lesq.), has been several times reported from America but I have been unable to find any American specimens of this species in any of the herbaria enumerated above. *Brachythecium albicans* has been reported as this species and very likely forms of *C. cirrosum* may have been referred here.

4. CIRRIPHYLLUM BOSCII (Schwaegr).

Hypnum Boscii Schwaegr. Suppl. **1**: 223. 1816.

Hypnum illecebrum Hedw. Spec. Musc. 252. *pl. 66* (excl. varieties). 1806.

Eurhynchium Boscii Jaegr. & Sauerb. St. Gall. Nat. Gesell. 1876–77: 361. 1878.

Myurium Boscii Kindb. Can. Rec. Sci. 1894: 73. 1894.

Gametophyte in thick soft loosely intricate cushions, or in loose thin mats, on the ground among the grass, glossy, golden-yellow to brownish-yellow; stems creeping or ascending, irregularly divided and branching; branches and shorter stems suberect, turgid, terete-foliate; stems often stoloniferous and subpinnately branching, sparingly radiculose, 5–15 cm. long; branches 1–3 cm. long, the longer more or less subdivided; branch leaves erect-open when moist, loosely imbricate when dry, decurrent, scarious, broadly ovate, very concave, spoon-shaped, 2–2.5 × 1.4 mm., serrate to the middle, apex rounded and abruptly acuminate, acumination twisted one-half turn to the right; basal angles rounded, subauriculate; costa extending three-fourths length of leaf; leaf-cells thick-walled, the median linear, 6–10: 1, basal and apical shorter and broader, the alar not differentiated; leaves of the stoloniferous stems much smaller, less abruptly narrowed to the longer acumination, costa shorter: stem leaves less concave, less abruptly acuminate, acumination longer, less frequently twisted: apparently dioicous, male branches not seen; perichaetial leaves with oblong-ovate sheathing bases, abruptly narrowed to a filiform spreading acumination, ecostate and entire or toothed below base of acumination. *Sporo-*

phyte 1.5–3 mm. high; seta red to red-brown, smooth, slightly twisted to the right; capsule brown, inclined, unsymmetric to arcuate, gradually narrowed into the seta, oblong, strongly arcuate and contracted under the mouth when dry, with operculum 3–4 × 1 mm.; annulus of at least two rows of cells; operculum conic, long rostrate, about one-half the length of urn; segments as long as the teeth, split between the articulations; cilia 2 or 3, well developed, nodose; spores nearly smooth, 16 μ; maturing in autumn.

Type locality, North America; collected by Bosc, probably in South Carolina. Type in the Boissier Herbarium at Geneva.

On the ground and rocks in shady places and open fields. Vermont to Florida and Louisiana, west to Missouri and Illinois; more abundant southward. The only specimen I have seen from Canada was of Drummond's collection and was in Prof. Macoun's collection as from "Upper Canada." Prof. Macoun suggests that it may have been from Niagara Falls.

ILLUSTRATIONS. Sulliv. Icon. Musc. *pl. 106.*

EXSICCATI. Drum. Musc. Am. (S. States), 132; Sulliv. Musc. Allegh. 42; Sulliv. & Lesq. Musc., Bor. Am. (Ed. 2) 435, (Ed. 1) 294; Austin Musc. Appal. 331; Ren. & Card. Musc. Am. Sept. Exsic. 117.

A very striking and easily identified moss, but one which is unique in many respects and whose relationships are obscure.

Specimens of *Myuroclada concinna* (Wils.) Besch. communicated to Mrs. Britton by Bescherelle have been carefully compared with *Hypnum Boscii*, Schwaegr. Bescherelle, Ann. des Sci. Nat. VII. **17**: 380, 1893, intimates that the latter species belongs to his new genus *Myuroclada*, founded upon the former. The two species resemble each other superficially to a striking degree. The glossy golden yellow turgid branches, rostrate operculum, smooth seta, and very concave cochleariform leaves are marked characteristics of both, but under the microscope such important differences appear that I am not able to consider them congeneric. *M. concinna* has the segments of the inner peristome slender with cilia very rudimentary or none; annulus lacking; leaves obtuse: *leaf-cells thick-walled, broadly oblong*, to *oblong rhomboid, 1–2 : 1. Hypnum Boscii* has the segments broader: cilia 2 or 3, well developed; leaves more or less long-acuminate, *leaf-cells linear, 8 10 : 1.*

The relationship of *Hypnum Boscii* to the other species referred to *Cirriphyllum* is somewhat less marked than the relationship between the other species of that genus, but it is closer than the relationship between *H. Boscii* and any other genus known to the author.

BRYHNIA Kaurin Bot. Not. 1892: 60. 1892.

(Named for the discoverer of the European representative of the genus, Dr. Nils Bryhn.)

Gametophyte medium sized, in intricate mats or cushions, bright yellowish green on the surface, dirty brownish green below. Stems creeping, irregularly divided and branching; central strand present. Leaves concave, serrate, decurrent, conspicuously papillose on the lower surface by the greatly thickened angles of the cell walls; median leaf-cells short, 4–6:1, rather thick-walled; basal and alar cells a little larger and more nearly rectangular. *Sporophyte* much as in *Brachythecium*. Seta rough, twisted to the right; capsule short-oblong, somewhat arcuate; operculum long-conic to subrostellate; annulus present, well developed; cilia one or two, well developed, nodose.

The two species which we have referred to this genus (previously known as *Eurhynchium Sullivantii* and *Brachythecium Novae-Angliae*) are undoubtedly very closely related and congeneric but the question of their further relationship is more difficult. They are seemingly intermediate between *Brachythecium* and *Eurhynchium* and were so regarded by the author of this genus. Limpricht admits the genus under protest and says that in his opinion the European representative belongs to *Brachythecium*. On the other hand, there has been an increasing tendency to refer the American representatives to *Eurhynchium*. The shortness of the leaf-cells is a character that does not pertain to *Brachythecium* (except in the anomalous *B. reflexum* and *B. cyrtophyllum*). The thickening of the angles of the cell walls to form papillae occurs in no species of *Brachythecium* and is much more strongly marked than in any other species referred to *Eurhynchium*. The sporophyte does not differ from that of *Brachythecium* except, perhaps, by the longer pointed operculum, but the operculum is far shorter than in *Eurhynchium*. On the whole, therefore, it seems more satisfactory to constitute a separate genus of these species.

M. Bescherelle (Ann. des. Sci. Nat. VII. **17**: 378. 1893) refers *B. Novae-Angliae* to *Scleropodium*, a disposition with which I cannot agree as the papillose leaves and the short leaf-cells are not characters of the genus as originally defined.

Branch leaves acute to short-acuminate, apex twisted.	1. *B. Novae-Angliae.*
Branch leaves longer acuminate, apex not twisted.	2. *B. graminicolor.*

1. BRYHNIA NOVAE-ANGLIAE (Sulliv. & Lesq.)

Hypnum Novae-Angliae Sulliv. & Lesq. Musc. Bor. Am. (Ed. 1) 338. 1856. Sulliv. Mosses of the U. S. 76. 1856.

Brachythecium Novae-Angliae Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876–77: 338. 1878.

Hypnum scabridum Lindb. Bot. Not. 1887: 41. 1887.

Bryhnia scabrida Kaurin Bot. Not. 1892: 60. 1892.

Eurhynchium Novae-Angliae Kindb. Can. Rec. Sci. 1894: 23. 1894.

Hypnum (*Cratoneuron*) *chloropterum* C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 231. 1892.

Eurhynchium chloropterum C. Muell. & Kindb. Can. Rec. Sci. 1894: 23. 1894.

Gametophyte in wide loosely intricate mats, bright green on the outside, dirty brownish green below, stems decumbent; secondary stems sub-erect, about 5 cm. long, subpinnately branching; branches erect-ascending, terete-foliate, often subjulaceous, 5–10 mm. long; branch leaves erect-open, loosely appressed-imbricate when dry, ovate to ovate-lanceolate, decurrent, 0.8–1.2 × 0.4–0.6 mm., serrulate, very concave, not plicate, papillose on the under side by the thickened angles of the cell walls, long-acute to short-acuminate; apex twisted one-half turn to the right; costa thick, extending beyond the middle of the leaf; median leaf-cells oblong-hexagonal, 5 : 1; alar and basal cells little differentiated, somewhat enlarged; stem leaves broadly ovate to triangular-ovate, 1–1.4 × 0.8–1.2 mm., nearly smooth, longer acuminate; leaf-cells shorter, areolation of decurrent angles somewhat more loose and more nearly rectangular: dioicous; male branches gemmiform; antheridia oblong; perigonial leaves oblong-ovate, gradually long-acuminate; perichaetium about 2 mm. long; the leaves with sheathing bases and squarrose points; inner leaves oblong, long filiform-acuminate, somewhat serrulate above, costate. *Sporophyte* 1–2 cm. high; seta dark red-brown, very rough with broad low papillae; capsule dark red-brown, almost black when old, oblong

cylindric, 3–3.5 mm. long, 4–5 : 1, somewhat arcuate, horizontal to suberect; operculum long-conic, subrostellate; annulus large; segments nearly as long as the teeth; cilia one or two, nearly as long as the segments, strongly nodose; spores minutely roughened, 17–19 μ, maturing in autumn or winter.

Type locality, mountains of New England.

On earth and stones in wet shady places, especially in mountain regions. Northeastern United States and eastern Canada; south to Maryland; west to Pennsylvania.

ILLUSTRATIONS. Sull. Icon. Musc. *pl. 118*. Limpr. Rab. Krypt. Pl. 4^3 : 139, *f. 377* (*Bryhnia scabrida*).

EXSICCATI. Sull. & Lesq. Musc. Bor.-Am. (Ed. 1) 338, (Ed. 2) 507; Aust. Musc. Appal. 329; Macoun, Can. Musc. 440; Ren. & Card. Musc. Am. Sept. Exsic. 109.

Easily distinguished by its rostellate capsule, short papillose leaf-cells and twisted leaf apices. The species varies considerably in length of the acumination of leaves so that var. *Delamarei* Ren. & Card. Fl. Miq. 50, does not seem worthy of special mention, although I have not seen specimens of that form.

Limpricht's description (*l. c.*) and several specimens of *Bryhnia scabrida* (Lindb.) Kaurin from Norway have been carefully compared with *B. Novae-Angliae* and the two are not to be distinguished. The measurements of the leaves given by Limpricht for *B. scabrida* are larger than those given for *B. Novae-Angliae* in my Rev. N. Am. Isotheciaceae and Brachythecia, but a further investigation has shown that the maximum measurements there given were too small. There is no difficulty in finding American plants with as large leaves as the European. Specimens of *B. Novae-Angliae* have been sent to Prof. Kaurin and were examined by him and submitted to his friend, E. Ryan. Both agree with me that the American and the European plant are the same. The Newfoundland plant referred by Kindberg to *B. scabrida* is certainly *B. Novae-Angliae*.

Mrs. Britton in 1889 first noted the great resemblance between *B. scabrida* and *B. Novae-Angliae* and sent specimens to Prof. Kaurin for comparison, but this was entirely overlooked in my revision of *Brachythecium*. In 1897 Dr. Best's attention was called to the matter by the Newfoundland plant named *B. scabrida* by

Kindberg, and Dr. Best very kindly called my attention to the great resemblance between the two plants.

Eurhynchium chloropterum seems to be nothing more than a slender lighter green form of *B. Novae-Angliae*, having the branch leaves more narrowly acuminate, more closely appressed and more contorted in drying. The areolation is not wider, and a specimen of Canadian Musci, no. 440 (on which the species appears to be founded), is most certainly dioicous. The perichaetial leaves are also faintly costate, as in the ordinary *B. Novae-Angliae*. It is found along the northeast coast of North America. Possibly it should be considered a variety. From my studies in this group I am led to believe that it is not a rare occurrence for male and female branches to occur on the same plant in a species that is ordinarily dioicous. *Vide* note on *Brachythecium Villardi*, Mem. Torr. Bot. Club, **6**: 180.

Mr. D. A. Burnett has communicated a peculiar form of this species from Bradford, Pa., growing on fine sand near the borders of a stream. The whole plant is much reduced and the leaves are more slenderly acuminate than usual.

2. BRYHNIA GRAMINICOLOR (Brid.).

Hypnum graminicolor Brid. Spec. Musc. **2**: 251. 1812.
Hypnum praelongum var. Sulliv. Musc. Allegh. 44. 1845.
Hypnum Sullivantii Spruce, A. Gray Man. Ed. 1. 1848.
Eurhynchium subscabridum Kindb. Ottawa Nat. **7**: 22. 1893.
Eurhynchium Sullivantii Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876–77: 354. 1878.

Gametophyte slender, in closely intricate mats or cushions, pale-green to yellow-green, dirty-brownish green below, stems 1–2.5 cm. long, creeping, irregularly divided and branching, sometimes stoloniferous, sparingly radiculose, often brown and denuded of leaves; branches ascending, 5–10 cm. long, terete-foliate; branch leaves loosely imbricate to open erect, ovate-lanceolate, 0.6–0.8 × 0.25–0.3 mm., decurrent, acuminate, sharply serrate nearly to base, concave with margins reflexed below, strongly papillose by the thickening of the angles of the cell walls; median leaf-cells small, linear-oblong, 4–6: 1; quadrate alar cells few; stem leaves 0.75–1 × 0.4–0.45 mm., longer, and more slenderly acuminate: dioicous; perichaetial leaves sheathing with spreading points; the

inner oblong-lanceolate, abruptly long filiform-acuminate, distantly serrulate, often with traces of a costa. *Sporophyte* 10–15 mm. high; seta red-brown, slightly twisted to the right, very rough with large crowded papillae; capsule red-brown, ovoid to subglobose, urn 1.5 mm. long and about two-thirds as broad; operculum short-rostrate, scarcely more than long conic when moist, one-half length of urn; annulus present, easily detachable; teeth very slender pointed; segments shorter than the teeth, little or not at all split; cilia two, well developed, nodose; spores nearly smooth, 13–15 μ, apparently maturing in autumn.

Type locality, Pennsylvania, Muhlenberg. Type at Geneva.

On the ground or rocks in moist and shady places. New Brunswick to Minnesota, Illinois, and Georgia; Missouri, Bush.

Local and rarely fruiting. Reported from Vancouver Island, Roell, Hedwigia, **35**: 69. 1896 but probably a mistake.

ILLUSTRATIONS. Sulliv. Icon. Musc. *pl. 105*.

EXSICCATI. Sulliv. l. c.; Sulliv. & Lesq. Musc. Bor. Am. (Ed. 1) 291, (Ed. 2) 430; Aust. Musc. Appal. 334; Macoun, Can. Musc. 296.

Distinguished from *B. Novae-Angliae* by its more slender habit, smaller and more slenderly acuminate leaves which are much more strongly papillose.

2a. BRYHNIA GRAMINICOLOR HOLZINGERI (Ren. & Card.).

Eurhynchium Sullivantii Holzingeri Ren. & Card. Bot. Gaz. **19**: 239. 1894.

More densely caespitose; branches shorter, generally obtuse; leaves broader, shorter acuminate.

Type locality in the District of Columbia, Coville; New Jersey, Best; Missouri, Demetrio.

This is the extreme variation in the direction of the characters noted above. The other extreme is reached in Drummond's Musc. Am. (S. States) 133 and Ren. & Card. Musc. Am. Sept. Exsic. 196, which is more straggling and stoloniferous; branch leaves more distant and open, lanceolate, reaching 1 mm. in length by 0.25 to 0.3 in breadth, long subfiliform acuminate, very strongly dentate-serrate and very strongly papillose roughened; stem leaves ovate-lanceolate, longer acuminate, reaching 1.3 mm. in length.

This latter form I have not yet seen fruiting. It appears from the data at hand to grow on moist rocks. It is widely distributed, occurring in Ontario, Connecticut, New York, Pennsylvania and Missouri. If it should prove to be a good variety and not merely habitat form, I would suggest the name *B. graminicolor acuminata.*

Eurhynchium subscabridum Kindb. approaches this form, and, according to the opinion of M. Cardot and myself, is in no way distinguishable from forms of *B. graminicolor.*

M. Cardot has seen Bridel's type of *Hypnum graminicolor,* and has very kindly communicated notes and camera lucida drawings of the leaves. We are both agreed that it is identical with *Hypnum Sullivantii* Spruce.

EURHYNCHIUM Br. & Sch. Bry. Eur., fasc. 57–61. 1854.

Gametophyte well developed, never minute, green to yellow-green, growing in wide loose mats, or sometimes in dense tufts. Stems prostrate or creeping, more or less pinnately branched, sometimes closely and regularly pinnate, usually somewhat stoloniferous; central strand present in all the species. Branch leaves pluriseriate, not complanate or secund, acuminate to obtuse, serrate, concave, more or less plicate; costa single, extending to the middle or beyond, usually ending in a spine underneath; median cells linear, 8–12 : 1, basal broader and shorter, alar quadrate or round, apical cells strongly differentiated and rhomboidal to circular in the group of *E. strigosum.* Stem leaves ovate, acute to long and slenderly acuminate. Paraphyllia sparingly present in some species. *Sporophyte,* as in *Brachythecium,* except the operculum, which is very long rostrate, equaling ½–⅓ the length of the urn, except in the group of *E. myosuroides.*

The species of this genus are quite closely related to *Scleropodium* and *Brachythecium,* and it is difficult to give any general character, except the long rostrate operculum, which distinguishes this genus from *Brachythecium.* It is distinguished from *Scleropodium* by the broader, shorter leaf-cells.

The genus can be divided into three groups:

I. The group of *E. strigosum,* including *E. strigosum, E. robustum, E. fallax, E. diversifolium,* and *E. hians.* This group is easily distinguished by the differentiated apical cells.

II. The group of *E. praelongum,* including *E. praelongum, E. Oreganum,* and *E. Brittoniae.* This group is characterized by the

broadly cordate-ovate, decurrent, abruptly long-acuminate stem leaves, and pinnate branching.

III. The group of *E. myosuroides*, including *E. myosuroides* and *E. stoloniferum*. This group is easily recognized by the shorter operculum and the small thick walled alar cells.

Apical cells of branch leaves oblong-rhomboidal to circular.*
- Seta rough. 1. *E. hians.*
- Seta smooth.
  - Leaves spreading.
    - Branch leaves 0.6–0.9 mm. long. 2. *E. strigosum.*
    - Branch leaves 1–1.5 mm. long,† round-obtuse at apex. 3. *E. fallax.*
  - Leaves appressed-imbricate.
    - Alpine or boreal; usually in dense mats or cushions; slender. 4. *E. diversifolium.*
    - Lowland; in looser mats; more robust. 2b. *E. strigosum praecox.*

Apical cells of branch leaves not differentiated.
- Alar cells merely broader and shorter than the median; operculum long rostrate.
  - Seta smooth or nearly so; stem leaves nearly entire. 6. *E. Brittoniae.*
  - Seta rough; stem leaves serrate.
    - Slender; variously branching, leaves not more than 1 mm. long. 5. *E. praelongum.*
    - Very robust; closely and regularly pinnate; branch leaves 1–1.5 mm. long. 7. *E. Oreganum.*
- Alar cells minute, thick-walled; operculum conic or short rostrate.
  - Branches seldom flagelliform; branch leaves 1–1.5 mm. long; plants of eastern North America. 8. *E. myosuroides.*
  - Branches often very long, flagelliform; branch leaves 1.5–2 mm. long; plants of the Pacific slope. 9. *E. stoloniferum.*

1. EURHYNCHIUM HIANS (Hedw.) Jaegr. & Sauerb, St. Gall. Nat. Gesell. 1876–77: 357. 1878.

Hypnum hians Hedw. Sp. Musc. 272, *pl.* 70, *f.* 11–14. 1801.
Hypnum praelongum Hedw. St. Cr. **4**: 76, *pl.* 29. 1797.
Pterigynandrum apiculatum Brid. Sp. Musc. **1**: 137. 1806.
Eurhynchium praelongum Br. & Sch. Bryol. Eur. fasc. 57–61. *pl.* 8 (Excl. var.). 1854.
Hypnum distans Lind. Musc. Scand. 34. 1879.

Gametophyte in intricate, depressed mats, green to yellow-green, closely adherent to the substratum; stems 3–10 cm. long, creeping, strongly radiculose, little divided, extensively stolonifer-

* *E. stoloniferum myurcellum* will be sought here.
† *E. strigosum robustum* has as large leaves, but they are acute.

ous, irregularly to subpinnately branching; branches ascending, nearly simple, 3–12 mm. long; branch leaves erect-spreading, appearing complanate when dry, 0.8–1.1 × 0.5–0.7 mm., ovate, not decurrent, obtusely acute to short-acuminate with apex often twisted to the right, sharply serrate to the base, concave to nearly plane, sometimes appearing papillose by the thickening of the angles of the cell-walls; costa stout, extending $\frac{4}{5}-\frac{5}{6}$ length of leaf, ending in a spine on the lower side of the leaf; median cells linear-oblong, 6–10 : 1; quadrate alar cells few, indistinct; apical cells rhombic, 2–3 : 1; leaves of stoloniferous stems small, 0.4–0.6 × 0.2–0.3 mm., ovate-lanceolate, rather abruptly narrowed into a slender acumination, costa thin and short; upper stem leaves much like branch leaves, short-acuminate: dioicous; perichaetial leaves oblong-ovate, sheathing, rather abruptly narrowed to a long squarrose-recurved acumination, nearly ecostate, distantly dentate-serrate above. *Sporophyte* 10–25 cm. high; seta dark red-brown, somewhat twisted to the right, very rough with low rounded papillae; capsule a little lighter colored, inclined to horizontal, oblong-cylindric, curved, urn 2–2.5 mm. long, 3 : 1; little or not at all contracted under mouth when dry; operculum long-rostrate, three-fourths length of urn; annulus present, narrow, easily detached; segments nearly as long as teeth, more or less split; cilia usually 2, sometimes 3, strongly nodose; spores nearly smooth, 10–12 μ, maturing in late autumn.

On the ground in moist, shady places. Canada to the Gulf of Mexico east of the Mississippi; Minnesota, Holzinger; Missouri, Bush.

Type locality, Pennsylvania.

EXSICCATI. Drumm, Musc. Am. (S. States) 134. Sulliv. Musc. Allegh. 53; Sulliv. & Lesq. Musc. Bor. Am. (Ed. 1) 290, (Ed. 2) 428; Aust. Musc. Appl. 335; Ren. & Card. Musc. Am. Sept Exsic. 118 (E. *praelongum*).

ILLUSTRATIONS. Sulliv. Icon. Musc. *pl. 104;* as *E. praelongum*, Hedw. l. c.; Br. & Sch. l. c.; as *E. Swartzii* Dixon & Jam. Handb. Brit. Mosses, *pl. 54* B.

A form from Florida (Austin, Underwood) has ovate-lanceolate branch leaves which are much more sharply acute than is usual.

A comparison of the difference between *E. praelongum* Hedw. and *E. hians* as given by Limpricht.

E. praelongum.	*E. hians.*
Not shining, golden green.	Golden green and opalescent, shining.

In the 50 or more specimens of each species that I have examined I have been unable to see that there is any difference in this respect.

All leaves distant. Stem leaves distant, branch leaves close.

There is a great variation in this respect in the plants referred to both species but I can detect no perceptible difference between the European *E. praelongum* (Hedw.) and the American *E. hians*.

Cells of stem leaves 5-8 : 1. Cells of stem leaves 7–12 : 1.

There is also a great variation in this respect in both, but no constant difference, and this variation does not seem to be correlated with the variations in the shape of the leaves.

Branch leaves almost plane. Branch leaves very concave.

There is absolutely nothing in this distinction. The leaves of either may be plane or concave and there are great differences in this respect even on the same plant.

Perichaetial leaves faintly costate. Perichaetial leaves ecostate.

Sullivant (Icones Muscorum, 163) says of *E. hians;* "Perichaetial leaves subcostate." There are faint but distinct traces of a costa in some or all of the perichaetial leaves in most of the *E. hians* I have examined. Mr. Dixon writes me that the perichaetial leaves of the British plant referred to *E. praelongum* Hedw. are often ecostate.

Seta purple. Seta red.

This also does not hold.

Annulus persistent. Annulus easily detachable.

I have not tried to verify this because it involved so much mutilation of specimens. It is a very doubtful distinction to say the least.

Seta 15–25 mm. long. Seta 10–13 mm. long.

The seta of the European plant does seem to average a little longer, but there are plenty of specimens of American *E. hians* with seta 15–25 mm. long. So far as can be determined the length of the seta is not correlated with any of the other characters given as distinguishing.

Capsule strongly contracted under the mouth when dry. Capsule not at all contracted under the mouth when dry.

I could distinguish absolutely no difference in this respect.

Spores faintly roughened. Spores smooth.

There is no perceptible difference in this respect.

Acumination of stem leaf one-tenth length of leaf.

Acumination of stem leaf one-sixth length of leaf.

There is a very great range of variation in this respect even on the same plant, but I was unable to discover any constant difference between the two.

All leaves similar in form.

Lower leaves lanceolate to ovate, 0.2–0.3 mm. wide, suddenly narrowed to a narrow reflexed acumination one-third the length of leaf.

Leaves of stoloniferous stem of both are much reduced in size and in very many cases long-acuminate in the European plant referred to *E. praelongum.*

To sum up: There is a very great range of variation in the characters enumerated above, especially in the width of the branch leaves and the length and slenderness of their acumination. The apex of the branch leaves of the European plant is slenderly acuminate in a larger proportion of cases than in the American, and the seta of the European plant averages longer.

E. hians is generally credited to Europe but the distinctions given will not hold as we have seen. If two species are to be made out of the European plants referred to *E. hians* and *E. praelongum* Hedw., the distinction will have to be based on different characters, one of which will, it seems to me, be the shape of the branch leaves. Our American plant differs considerably in this respect. Specimens from the Southern States have, as a rule, more slenderly pointed branch leaves, but there are all grades of intermediate forms and the difference is too slight to be of specific rank.

All the variations of the American plant can be duplicated in the European plant referred to *E. praelongum,* but the European plant varies further in the direction of narrow slenderly acuminate branch leaves with fewer differentiated apical cells.

Lindberg (*l. c.*) when separating *Hypnum distans* from *H. hians* evidently took his idea of *H. hians* from Sullivant's figure, which does not accurately represent the American plant as I understand it after having examined hundreds of specimens. In Sullivant's figure the leaves are much more slenderly acuminate and the apical

cells much narrower in proportion to their length than in almost all the plants I have seen. The figures of the branch leaves of *E. praelongum* (Hedw.) in the Bryologia Europea represent the branch leaves of *E. hians* much better than Sullivant's figure. The other European authors who have treated this species since Lindberg wrote seem to have adopted substantially his idea of *E. hians*.

Mr. H. N. Dixon has exchanged a large number of specimens with me and has carefully gone over the evidence of the identity of the European and American plant. He believes that *Hypnum atrovirens* Swartz, Disp. 65. 1799, is also identical with *E. hians*.

2. EURHYNCHIUM STRIGOSUM (Hoffm.) Br. & Sch. Bryol. Eur. fasc. 57–61, *pl. 519*. 1854.

Hypnum strigosum Hoffm., D. Fl. **2**: 76. 1796.

Hypnum thuringicum Brid. Musc. Recent. **2**^{2}: 99. *pl. 3. f. 2.* 1801.

Hypnum pulchellum Hedw. Sp. Musc. 268. *pl. 68 f. 1–4.* 1801.

Hypnum velutinoides Voit. Musc. Herbip. 99. 1812.

Rhynchostegium strigosum De Not. Cronaca, **2**: 11. 1867.

Gametophyte in wide loose mats, with a habit much like *Brachythecium velutinum*, green to yellow-green, stems creeping, densely radiculose, 5–10 cm. long, often stoloniferous at the ends, pinnately to subfasciculately branching; branches 3–8 mm. long, ascending or erect, terete-foliate, often appearing somewhat complanate foliate when dry, attenuate at the ends; branch leaves from the middle of the branches erect-spreading, ovate-lanceolate, very slightly, or not at all decurrent, 0.7–1 × 0.3–.55 mm., acute or often obtuse, especially towards the ends of the branches, sharply serrate above, concave, little or not at all plicate; costa extending four-fifths length of leaf, ending in a spine underneath, median leaf-cells linear, 7–10 : 1; quadrate and oval alar cells few, apical cells conspicuously shorter and broader, oblong-rhomboidal, 2–3 : 1; stem leaves elongated-triangular-ovate, more or less long-acuminate, gradually slender pointed, somewhat decurrent, serrate, 0.9–1.2 × 0.4–0.6 mm.; apex often twisted half around to the right; leaves of the stoloniferous stems, triangular-ovate, abruptly long-acuminate, ecostate, 0.7–5 × 0.3 mm.: dioicous or pseudo-monoicous, "annual buds containing antheridia adhering to radicle of fertile plants;" perichaetial leaves with sheathing bases and spreading points, oblong, narrowed to a slender subfiliform spreading acumination, ecostate, distantly serrate.

Sporophyte 10–20 mm. high; seta red-brown, smooth, twisted to the right; capsule brown to red-brown, oblong-ovoid to oblong-cylindric, unsymmetric, inclined to horizontal; urn 2–2.5 : 1, constricted below mouth when dry; operculum ½–⅔ length of urn, abruptly long-rostrate; annulus of 2 or three rows of cells; segments nearly as long as teeth, split; cilia 2 or 3, nodose; spores 10–12 μ, nearly smooth, maturing in autumn.

Type locality, European.

On the ground, roots of trees, and decaying logs in woods and shady places; seemingly preferring steep shaded banks of ravines.

Ranging from Washington, British Columbia and Alaska to Labrador, south to the White Mountains, the Adirondacks, and the mountains of Colorado.

ILLUSTRATIONS. Br. Sch. l. c; Hedw. l. c.; Wils. Bryol. Brit. *pl. 55;* Husnot, Musc. Gall. *pl. 96;* Dixon & Jam. Handb. Brit. Mosses, *pl. 54. K.*

The leaves of this species and its relatives vary so in shape that any attempt to define species by the degree of acuteness of the leaves or other similar character seems futile.

2a. EURHYNCHIUM STRIGOSUM ROBUSTUM Röell, Hedwigia, **36**: 52. 1897.

Eurhynchium strigosum (in part) of American authors.

Gametophyte with the habit of *Brachythecium plumosum*, in wide intricate mats, green to yellow-green; stems creeping, densely radiculose, 5–10 cm. long, often stoloniferous at the ends, pinnately or subfasciculately branching; branches 6–12 mm. long, ascending or erect, often fasciculately divided, terete-foliate, more blunt than in *E. strigosum*; leaves from the middle of the branches erect-spreading, ovate-lanceolate, very slightly or not at all decurrent, 1–1.3 × 0.4–0.5 mm., usually acute; quadrate and oval alar cells confined to the extreme angles; stem leaves 1.2–1.5 × 0.4–0.6 mm., longer acuminate, acumination often subfiliform. *Sporophyte* rather larger than in the typical form.

Type locality, vicinity of Chicago, Illinois. Type duplicate in the herbarium of Columbia University.

Eastern Canada and in the United States from Louisiana to Minnesota and eastward. More abundant northward.

EXSICCATI. (As *Hypnum strigosum.*) Drumm. Musc. Am. (S. States) 131; Sulliv. Musc. Allegh. 11; Sulliv. & Lesq. Musc.

Bor.-Am. (Ed. 1) 292, in part, (Ed. 2) 431, in part; Aust. Musc. Appal. 332; Macoun, Can. Musc. 295.

The great majority of plants from eastern North America that have been referred to *E. strigosum* belong to this variety. Forms agreeing very closely with European *E. strigosum* are not rare in the United States and Canada, and are seemingly more frequent in elevated regions. Intergrading forms are very numerous, diversified, and extremely puzzling.

2b. EURHYNCHIUM STRIGOSUM PRAECOX (Hedw.) Husnot, Musc. Gall. 332. 1893.

Hypnum praecox Hedw. Spec. Musc. 249, *pl. 64*. 1801.

Gametophyte caespitose or in looser intricate mats, green to yellow-green; stems creeping, 2–3 or even 8 cm. long, irregularly divided, subfasciculately branching, often stoloniferous; branches 3–6 mm. long, erect, julaceous, usually blunt; branch leaves crowded, imbricate-appressed when dry, erect-open when moist, cordate-ovate, more or less decurrent, 0.5–0.8 × 0.4–0.6 mm., almost acute to very obtuse and rounded at apex, serrate above, serrulate nearly to the base, more or less plicate, concave with borders often reflexed below; costa extending at least three-fourths the length of the leaf, ending in a spine underneath; median cells linear-oblong, 6–8 : 1; quadrate and oval alar cells numerous, apical cells rhomboidal to nearly circular; leaves of the stolons much as in *E. strigosum;* stem leaves acute to abruptly filiform-acuminate, triangular-ovate, decurrent, 0.8–1 × 0.6 mm., serrulate, costate to the middle. *Sporophyte* 6–10 mm. high; capsule ovoid, unsymmetric, horizontal; urn 1.5–2 : 1, more or less contracted under the mouth when dry and empty; operculum two-thirds length of urn, convex, abruptly long-rostrate; cilia 1–3, strongly nodose; spores very finely roughened, about 12 μ, maturing in autumn.

"More depauperate than the species, tufts loose, deep green; stems shortened, thick and nearly naked; branches and branchlets erect, 3–5 mm. long; stem leaves 0.7 mm. long by 0.4 mm. broad, plicate; branch leaves close, appressed-imbricate, broadly ovate, short acuminate, 0.6 mm. long by 0.3 mm. broad, margins somewhat reflexed above the middle, plicate; the upper branch leaves sometimes obtuse; leaf-cells 6 μ long, 10 : 1, elongated in the acumination; costa extending three-fourths the length of the leaf, ending in a spine on the under side. Sporophyte like the species; seldom fruiting." *Limpricht, Rab. Krypt. Fl.* 4^3 : 159. 1897.

On shady banks, moist soil and rocks. New York, New Jersey, Pennsylvania; Texas, G. Jeremy.

Type locality, Sweden.

ILLUSTRATIONS. Br. & Sch. Br. Eu. *pl. 519, f. β.*

EXSICCATI. Drumm. Musc. Am. (S. States) 130 (*Leskea fasciculosa*); Sulliv. & Lesq. Musc. Bor.-Am. (Ed. 1) 293, (Ed. 2) 432; Aust. Musc. Appal. 333.

Distinguished from the species by the julaceous branches, appressed-imbricate leaves, more obtuse and more decurrent.

2c. EURHYNCHIUM STRIGOSUM SCABRISETUM var. nov.

Seta plainly scabrous with scattered papillae; otherwise like var. *praecox*.

On shaded ground.

Type in the Columbia Herbarium from the Palisades, N. J., Austin; Sargentsville, N. J., Best; Rensselaer Co., N. Y., E. C. Howe; Vineyard Haven, Mass., R. E. Schwab.

In most sets of both editions of Sulliv. & Lesq. Musc. Bor.-Am. a portion of the specimen labeled *E. strigosum* is smaller and has julaceous branches and in some sets of Ed. 1, a scabrous seta. This portion I should refer to var. *praecox* or var. *scabrisetum* as the case may be.

The roughening of the seta is a character not mentioned in any European work or observed in any European specimen, and is probably a new development.

As a rule the branch leaves of *E. fallax* are strongly decurrent, those of *E. strigosum praecox* and *E. diversifolium* somewhat so, while those of *E. strigosum* are usually not at all decurrent. The stem leaves of all these forms are more or less decurrent.

All the available literature on *E. strigosum, E. strigosum praecox* and *E. diversifolium* has been carefully studied to discover a satisfactory arrangement of the forms usually referred to these species. The result has been very unsatisfactory and the matter cannot be definitely settled until the types are compared with American material. The European material in the Herbarium of Columbia University indicates that the forms usually referred to *E. diversifolium* belong rather to *E. strigosum praecox* and ac-

cordingly this ground is taken provisionally. Limpricht's description of the variety *praecox* is copied and a full description of the American plant is given. Some discrepancies will be noted. Some of the American forms referred provisionally to var. *praecox* are more robust than any European material which has been examined. Limpricht says that the true *E. diversifolium* is a true alpine moss, "Ein echtes Hochalpenmoos," which the *E. diversifolium* of Lesq. & James and most other American authors is not.

In the mountainous and boreal regions of the northern United States and Canada west of the longitude of the Mississippi there is found an alpine moss which agrees very closely with Rabenhorst's Bryoth. Eur. No. 1143 (*E. diversifolium*), which is cited by Limpricht (*l. c.* 160). This western plant has been referred to *E. diversifolium*. This view is seemingly contradicted by the fact that Schimper in the Bry. Eur. under *E. diversifolium* refers to it specimens from Ohio.

Whatever may be true of the names, the forms described, though intergrading to a considerable extent, are still so well defined as to be readily recognized.

3. EURHYNCHIUM FALLAX (Ren. & Card.).

Eurhynchium strigosum var. *fallax* Ren. & Card. Bot. Gaz. **14**: 98. 1889.

Eurhynchium substrigosum Kindb. Macoun, Cat. Can. Pl. 6: 205. 1892.

Gametophyte in loosely intricate mats; robust, green to light yellow-green; stems 5–10 cm. long, procumbent, arcuate, ascending, often stoloniferous and rooting at the ends, giving off several secondary stems that bear comparatively few branches, branching irregular to subpinnate; branches 7–15 mm. long, terete-foliate, attenuate; branch leaves erect-open, usually long-decurrent, cordate-ovate to lanceolate-lingulate, 0.8–1.2 × 0.4–0.55 mm., rounded-obtuse, serrate above, serrulate to the base, concave, usually slightly plicate when dry; costa extending about seven-eighths the length of the leaf, ending in a spine underneath; median leaf-cells linear, 9–12 : 1; quadrate alar cells numerous; apical cells of various shapes, oblong-elliptical, elliptical, and circular; stem leaves larger and more narrowed at apex, 1.2–1.5 × 0.5–0.8 mm., only the lower and those of the stoloniferous stems acute or long-acuminate: monoicous; male branches scarce: perichaetial leaves with oblong

sheathing bases, very abruptly narrowed to filiform erect-spreading acumination, the inner with a long thin costa, serrulate or entire. *Sporophyte* 15–20 mm. high; seta red-brown, smooth, twisted to the right; capsule brown, oblong, unsymmetric, horizontal; urn 2.5 × 1 mm., little constricted below the mouth when dry and empty; operculum conic, abruptly long-rostrate, beak two-thirds length of urn; annulus present, of at least two rows of cells; cilia stout, 2 or 3, nodose to subappendiculate; spores minutely roughened, 10–13 μ, maturing in winter.

Type locality, on old logs, Lake Pend d'Oreille, Idaho, Leiberg.

On the ground, roots of trees and decaying logs. Northern United States and Canada, in the Rocky Mountain region. Alaska, O. S. Bates; British Columbia, Macoun; Idaho, Sandberg, and Leiberg; Montana, Watson; Colorado, Wolf and Rothrock.

EXSICCATI. Ren. & Card. Musc. Am. Sept. Exsic. 116. Macoun, Can. Musc. 449, in the Columbia Herbarium as *E. substrigosum* Kindb., is not the species, but appears to be *E. strigosum robustum*. Authentic material of *E. substrigosum* has been examined.

Distinguished from *E. strigosum robustum* by the more diffuse straggling habit, more distant leaves, branch leaves broad and rounded at apex, and less acute stem leaves; from *E. strigosum* and its other varieties, and the other closely allied species it is easily distinguished by its greater size and looser habit.

3a. EURHYNCHIUM FALLAX BARNESII (Ren. & Card.).

Eurhynchium strigosum var. *Barnesii* Ren. & Card. Bot. Gaz. **14**: 98. 1889.

Stouter, with more slender, lingulate leaves which are also narrower at apex; capsule much larger and thicker.

Type locality the same as for the species.

Collected several times in Idaho by Sandberg and by Leiberg.

4. EURHYNCHIUM DIVERSIFOLIUM (Schleich.) Br. & Sch. Bry. Eur. fasc. 57–61, *pl. 520*. 1854.

Hypnum diversifolium Schleich. in Herb. and Catal. 1807. (In part.) *Teste* Limpricht.

Eurhynchium strigosum var. *diversifolium* Molendo & Lorentz, Flora. 1867.

Gametophyte caespitose or in thick, densely intricate mats, green to yellow-green; stems 2–7 cm. long with long thick stolons, creeping, densely radiculose, sending up numerous fasciculately divided branches; branches short, 2–5 mm. long, julaceous, blunt; branch leaves appressed-imbricate, ovate, acute or rounded-obtuse, 0.5–0.6 × 0.36–0.45 mm., serrulate, concave, excavate at the slightly decurrent angles; costa extending four-fifths length of leaf, often ending in a spine underneath; median leaf-cells linear to linear-oblong, 5–8 : 1, apical rhomboidal or nearly circular; area of quadrate alar cells much larger than in any of the allied species; stem leaves ovate, acute to long-acuminate, decurrent, 0.8–1 × 0.6–0.75 mm.; leaf-cells narrower and longer, apical cells not differentiated; costa seldom ending in a spine; leaves of stoloniferous stems varying greatly in size on the different parts of the stolon: slightly open, without chlorophyll, elongated-triangular, long and narrowly acuminate; excavate at the angles, very long and narrowly decurrent; costa slender or wanting, "dioicous or pseudo-monoicous;" perichaetial leaves sheathing at base, with spreading acumination, oblong-ovate, abruptly long-acuminate; costa thin or wanting. *Sporophyte* 5–10 cm. high; seta red-brown, smooth, twisted to the right; capsule red-brown, ovoid to short-oblong, unsymmetric and inclined; 1.5 : 1, slightly contracted under the mouth when dry; operculum long-rostrate, nearly as long as the urn; "annulus of two rows of cells, persistent;" segments from a basal membrane one-third the length of the teeth; cilia 2 or 3, appendiculate; spores finely roughened, 14–18 μ, maturing in winter.

Type locality, European. Type at Kew.

On the ground and rocks in mountainous and boreal regions of western North America, especially in the Rocky Mountain region. Utah, Watson; British Columbia, Macoun; Idaho, Leiberg; Montana, R. S. Williams; Colorado, Mrs. S. L. Clark, and Marie Holzinger; Ohio, *fide* Schimper, l. c.; S. Dakota, M. A. Thompson.

ILLUSTRATIONS. Br. & Sch. l. c.; Husnot, Musc. Gall. *pl. 96, f. 8–9*; Limpricht, Rab. Krypt. Fl. 4^3, *f. 34*.

EXSICCATI. Macoun, Can. Musc. 500.

Limpricht, *l. c.*, describes the branch leaves as round-obtuse with the costa seldom reaching three-fourths of the length of the leaf, but Rabenhorst's Bryotheca Europea, 1143, which he cites agrees with the American material in these respects as well as in the di-

mensions of the leaf-cells. It seems pretty certain that our American plant here referred to *E. diversifolium* agrees with Limpricht's idea of this species and it certainly agrees with the accessible European exsiccati. While resembling *E. strigosum praecox* in many ways it can be readily distinguished by its slender habit, smaller branch leaves and more numerous quadrate alar cells.

5. EURHYNCHIUM PRAELONGUM (Dill. L.) Bryhn, Explor. Bryol. in Valle Norv. Stördalen, 59. 1893. (*Fide* Limpricht.)

Hypnum repens filicium, triangularibus parvis foliis praelongum Dill. Cat. Giss. 219. 1718, et Hist. Musc. 278. *pl. 35, f. 15a.* 1741, et herbarium (*Teste* Lindberg).

Hypnum praelongum L. Sp. Pl. 1125. 1753. (Non Hedw. St. Cr. **4**: 76. *f. 29.* 1797.)

Eurhynchium pseudospeciosum Kindb. Can. Rec. Sci. 1894: 22. 1894.

Eurhynchium acutifolium Kindb. Rev. Bryol. **22**: 84. 1895.

"Stems (in the type) slender, prostrate, elongated (2–5 inches), divided; at intervals rather regularly pinnate, with slender, somewhat attenuated, often curved, not very crowded, subcomplanate branches; forming low, somewhat straggling masses of a bright or dull green, less commonly yellowish. Stem leaves distant or more rarely crowded, widely cordate-triangular or widely ovate-cordate, rapidly or even abruptly and longly acuminate in a long often almost filiform, squarrose acumen; at base wide, excavate, strongly decurrent; margin plane, regularly and distinctly denticulate, nerve slender, reaching above half-way and usually into the acumen; cells linear, slightly vermicular, tapering but obtuse, 10–18 times as long as wide, pellucid; towards base wider and shorter, lax, at angles large, subrectangular, but not forming clearly defined auricles. Paraphyllia occasionally but not always present. Branch leaves much narrower, widely or even narrowly lanceolate, gradually acuminate, very acute, somewhat erect when dry, more spreading when moist, not complanate, moderately soft in texture and often twisted when dry, not plicate, hardly glossy. Perichaetial bracts squarrose, very longly acuminate. Seta rather long, often one inch. Capsule turgidly ovate, narrower when ripe and empty, horizontal, abruptly passing into the seta at base, rather large; lid subulate-rostrate, usually decurved, almost as long as the capsule. Dioicous."

The above excellent description is copied from Dixon and

Jameson's Handbook of British Mosses, p. 416. The species is rare in America and Mr. Dixon has had a much better chance to become acquainted with it, as it is common in England.

Type locality European.

On soil and decayed stumps.

California: Bolander, no. 83;* Olema, Marin Co., Jan. 11, 1894 (on old logs) Howe; San Mateo Mts., S. H. Burnham; White Mts., N. H., Oakes; Oregon, Hall; Vancouver Island, Lyall, Macoun; Washington, Suksdorf, Piper, Fenzler.

ILLUSTRATIONS. Dill. *l. c.;* Dixon & Jam. Handb. Brit. Mosses, *pl. 54 A.*

EXSICCATI.* Sulliv. & Lesq. Musc. Bor. Am. (Ed. 2) 433, (*Hypnum Stokesii*). Also sent out by Macoun as No. 100 of his Canadian Cryptograms under the name of *Eurhynchium pseudospeciosum.* Canadian Musci 442 (*E. hians*?).

There has been an almost endless amount of confusion as to the nomenclature of this plant. Wilson, Mitten, Dixon and Lindberg have applied the name to one plant, and Hedwig, Schimper, Husnot, Limpricht, and Cardot to another. The plant of Lindberg and the British bryologists is very closely allied to *E. Stokesii*, indeed, the latter appears to be only a variety of it. The *E. praelongum* of Hedwig and Schimper is identical with our *E. hians.* Now the two species that have borne this name are utterly and entirely distinct and could not be confused by the veriest tyro. The decision as to what is the true *E. praelongum* must rest with the Dillenian plant on which Linnaeus founded *Hypnum praelongum.* Lindberg saw the plant in Dillenius' herbarium† and declares that it is the plant that the British bryologists have called *E. praelongum.* As Lindberg was an acute observer, and has the best possible grounds for his opinion, I shall follow him until something more authoritative appears. One reason for the continuance of the confusion is the fact that the true *E. praelongum* is rare on the continent

* Mr. Dixon has examined the starred plants.

†Lindberg's statement is found in his Kritik Granskning af Mossorn uti Dillenia Historia Muscorum, 17, 1883. He gives the following citation from Dillenius' Hist. Musc. and herbarium: "15. H. repens filicinum triangularibus parvis foliis praelongum. P. 278, tab. 35. fig. 15. Herb. fol. 93. no. 15." He then adds this note: "Fig. A. Hypnum praelongum L. c. fr. —vera planta, cujus subspecies H. stokesii Turn. est nec auctorum recentiorum (h. e. H. distans Lindb.)."

and in America and when found has nearly always been referred to *E. Stokesii.*

E. praelongum is distinguished from its variety *Stokesii* by its less robust, more straggling appearance, less rigid stems, fewer paraphyllia and less regularly pinnate and less bipinnate branching. There is not the difference between the relative dimensions of the leaf-cells that is indicated by the two descriptions. I think Mr. Dixon's figures are too large. The leaves of the species are frequently more distant than those of the variety and the branches are much fewer in number.

Dr. Roell has sent to Mrs. Britton specimens of Fenzler's collection of *Eurhynchium acutifolium* Kindb. from the type locality at Enumclaw, Washington. This plant is not different from *E. praelongum.* It is described as "monoecious" but one fragment 3 cm. long bore five male branches and no female thus giving evidence of being dioicous. Fenzler's plant is a brighter yellow than the majority of specimens of *E. praelongum.*

5a. EURHYNCHIUM PRAELONGUM STOKESII (Turn.) Dixon l. c.

Hypnum Stokesii Turn. Musc. Hiber. 159. *pl. 15. f. 5.* 1804.
Hypnum praelongum var. *Stokesii* Brid. Sp. Musc. **2**: 103. 1812.
Eurhynchium Stokesii Br. & Sch. Bryol. Eur. fasc. 57–61. *pl. 526.* 1854.

Gametophyte in wide intricate mats, green to light yellowish green; stems rigid, procumbent, often stoloniferous, irregularly divided; 10–13 cm. long, sparingly radiculose, sending up suberect secondary stems which are closely and regularly pinnate, often bipinnate and 2–3 cm. long, branching more or less perfectly pinnate; branchlets slender, 3–13 mm. long, terete-foliate; branch leaves erect-open, decurrent, ovate-lanceolate, acuminate, 0.7–0.8 × 0.45 mm., smaller at the apex of the branches and on the smaller branchlets, serrate above, serrulate to the base; angles of the cell walls very slightly papillose-thickened; costa extending three-fourths length of leaf, often ending in a spine underneath; median cells oblong-linear, 5–8 : 1, broader and shorter at the decurrent angles; stem leaves distant, squarrose, strongly decurrent, triangular-ovate, abruptly long and slenderly acuminate, 0.7–0.9 × 0.9–1.3 mm., serrate (nearly entire on some of the stoloniferous portions) basal cells thicker walled, quadrate alar cells more numerous than in the branch leaves; paraphyllia borne sparingly on the stems (Dixon *l.*

c. describes the paraphyllia as numerous), leaf-like, triangular-ovate to ovate-lanceolate: dioicous; perichaetial leaves ovate with sheathing bases, abruptly narrowed to a long slender squarrose acumination, strongly dentate-serrate, ecostate. *Sporophyte* 2–3 cm. high; seta red-brown, stout, twisted to the right, very rough with large blunt papillae; capsule oblong-ovoid, red-brown, slightly unsymmetric, horizontal, slightly contracted under the mouth when dry; urn about 2 mm. long, 1.5–2 : 1; operculum long-rostrate, nearly as long as urn; annulus large, easily detachable; segments nearly as long as the teeth; cilia 2 or 3, nodose; spores 10–14 μ, maturing in late autumn or early winter.

Type locality, Ireland.

On the ground and roots of trees, west of the Rocky Mountains in the northern United States and Canada, Idaho, Washington, Oregon, California, Vancouver Island, British Columbia. Apparently common within this range. Newfoundland (*Fide* Cardot).

ILLUSTRATIONS. Turner, l. c.; Br. & Sch. l. c.; Husnot, Musc. Gall. *pl. 98.*

EXSICCATI. Macoun, Can. Musc. 297; Ren. & Card. Musc. Am. Sept. Exsic. 119.

Our American plant is as a rule considerably stouter than the European and more regularly pinnate varying towards *E. Oreganum* which is most certainly a derivative of it. One of the best characterized of these forms is

5b. EURHYNCHIUM PRAELONGUM CALIFORNICUM var. nov.

Gametophyte with the habit of a *Thuidium*; stems 15–20 cm. long, closely and regularly pinnate, seldom stoloniferous, more robust throughout; leaves of the maximum size.

Type from California, Bolander no. 46. 1876. In the herbarium of Columbia University.

6. EURHYNCHIUM BRITTONIAE sp. nov.

Gametophyte in wide intricate mats, dark green; stems creeping, radiculose, 5–10 cm. long, sparingly divided; branching closely and regularly pinnate; branches 5–10 mm. long, teretefoliate; branch leaves open-erect, 0.7–0.9 × 0.3–0.4 mm., gradually long-acuminate, lanceolate to ovate-lanceolate, serrate to the base, slightly or not at all decurrent; leaf-cells oblong-linear, 5 : 1, alar

quadrate; costa extending four-fifths the length of the leaf, often ending in a spine underneath; stem leaves deltoid-ovate, 1.8 × 1 mm., including the filiform acumination which is 0.5–0.8 mm. long, serrulate at base, nearly entire above, strongly excavate at the decurrent angles; quadrate and rhomboidal alar cells numerous; perichætial leaves sheathing at base, ovate to oblong-ovate, with a long filiform squarrose acumination, ecostate, distantly spinose toothed on the margins above. *Sporophyte* 1.5–2 cm. high; seta red-brown, twisted to the right, nearly or quite smooth; capsule oblong-cylindric, unsymmetric and horizontal; urn 1.5 mm. long, 2 : 1, contracted below the mouth when dry; operculum long-rostrate, at least two-thirds the length of the urn; annulus? segments from a basal membrane which is at least two-thirds the height of the teeth; segments split between the articulations; cilia 2 or 3, strongly nodose; spores finely roughened, about 15 *μ*.

Type from California, Bolander. Specimens of this species of Bolander's California collections are in the National Museum from "Little River (Mendocino Co.?) at the foot of pine tree, no. 332." Also in the herbarium of Mr. J. M. Holzinger as no. 530.

This species is very closely related to *E. praelongum Californicum* and greatly resembles it in appearance but is easily distinguished by its nearly smooth seta and nearly entire stem leaves.

Named in honor of Mrs. E. G. Britton in recognition of her assistance in the preparation of this monograph and of her services to American bryology.

7. EURHYNCHIUM OREGANUM (Sulliv.) Jaeger & Sauer. St. Gall. Nat. Gesell. 1876–77 : 361. 1878.

Hypnum Oreganum Sulliv. Mem. Am. Acad. 4 : 172. 1849.

Gametophyte in wide loose mats; yellow-green above, brownish green below the surface; stems procumbent, densely radiculose at points of contact with substratum, 6–25 cm. long; sparingly divided, closely and regularly pinnate, often bipinnate; branches 1.3–2.5 cm. long; branches terete-foliate, tapering; branch leaves open, erect, decurrent, broadly cordate-ovate, 1–1.5 × .75–1 mm., acuminate, sharply serrate above, serrulate to base, somewhat concave and slightly plicate, costa stout, extending nearly to base of acumination, ending in a spine at the back; median cells linear, about 7.1; extreme alar cells thick-walled, oblong to rhomboidal; stem leaves larger, reaching 2 × 1.3 mm., more broadly ovate, longer acuminate: dioicous; male branches abundant; perigonial leaves ovate, long-acuminate, ecostate, distinctly dentate; antheridia numerous, clavate; perichaetial leaves sheathing at base with reflexed points, ovate to oblong-ovate, abruptly long

and slenderly acuminate, ecostate, sharply dentate-serrate. *Sporophyte* 2–2.5 cm. high; seta red-brown, twisted to the right, very rough with high blunt papillae; capsule lighter colored, horizontal to slightly drooping, unsymmetric, oblong-ovoid, 2–2.5 mm. long, 2–1, slightly contracted under the mouth when dry and deoperculate; operculum a little shorter than urn; annulus present, well developed, of at least two rows of cells, easily detachable; segments as long as the teeth, more or less split between the articulation; cilia 2–3, well developed; nodose to short-appendiculate; spores 15–20 μ, nearly smooth, maturing in winter.

On the ground, decaying logs and base of trees. California, Oregon, Washington, Vancouver Id., Idaho, British Columbia.

ILLUSTRATIONS: Sulliv. Bot. Wilkes Expd. Musc. 16. *pl. 13. B.*

EXSICCATI. Sull. & Lesq. Musc. Bor.-Am. (Ed. 2) 434; Macoun, Can. Musc. 298; Ren. & Card., Musc. & Am. Sept. Exsic. 120.

A beautiful species, closely allied to *E. Stokesii;* easily distinguished from that and other species by its large size and regularly pinnate stems.

8. EURHYNCHIUM MYOSUROIDES (Dill. L.) Schimp. Syn. Ed. 1: 549. 1860.

Hypnum myosuroides tenus capsulis natantibus Dill. Hist. Musc. 317, *pl. 41, f. 51.* 1741, and Herb.

Hypnum myosuroides L. Sp. Pl. 1130. 1753.

Isothecium myosuroides Brid. Bryol. Univ. **2**: 369. 1827.

Rhynchostegium myosuroides DeNot. Epil. 79. 1869.

Gametophyte in soft intricate light green to brownish green tufts; primary stems creeping, secondary stems 15–25 mm. long, suberect, dendroid and often stoloniferous, frequently becoming arcuate and giving off dendroid innovations like *Hylocomium proliferum;* branching subpinnate to fasciculate; branches often again divided; ultimate branchlets 5–8 mm. long, sometimes flagelliform and much lengthened; branch leaves pluriseriate, often somewhat secund, ovate-lanceolate to oblong-lanceolate, 1–1.3 × 0.25–0.35 mm., acute to-long acuminate, serrulate at apex, sometimes papillose at apex on the back by the thickening of the angles of the cell walls; costa extending to the middle or beyond, sometimes forking; median leaf-cells linear, 5–7: 1; alar cells round-quadrate, incrassate; stem leaves triangular-ovate, long-acuminate, less strongly serrate, basal cells often thick-walled and brown; leaves of primary stems very small, distant, squarrose;

paraphyllia none : dioicous ; male branches gemiform, small ; inner perigonial leaves ovate, acuminate, concave, ecostate, slightly denticulate ; perichaetium 2–3 mm. long, the inner leaves with an ovate-lanceolate sheathing base and a long squarrose-recurved acumination, serrate above, costate. *Sporophyte* 1.5–2 cm. high ; seta smooth, twisted to the left above or often irregularly bent, and twisted ; capsule brown, oblong-ovoid, suberect, and slightly unsymmetric to horizontal and curved, 2–2.5 mm. long, 3–4 : 1 ; operculum conic, apiculate to short-rostrate ; annulus of 2–3 rows of cells, easily deciduous ; segments from a wide basal membrane, as long as the teeth, more or less split along the median line ; cilia 2 or 3, nearly as long as the segments ; spores minutely roughened, about 16 μ, maturing in autumn or early winter.

Type locality European ; type at Oxford in the Dillenian herbarium.

In cool shady places on rocks and roots of trees in alpine and boreal regions. Rare in America. Trinity Bay, Newfoundland, Waghorne ; Nova Scotia, James ; White Mts. (North Conway) N. H. Oakes.

ILLUSTRATIONS. Dill. l. c. ; Br. & Sch., Bry. Eur. *pl. 434 ;* Wilson, Bry. Brit. *pl. 25*, Dixon & Jam. Handb. Brit. Mosses, *pl. 54. H.*

EXSICCATI. Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 424.

Our eastern plant agrees very closely with the European *E. myosuroides*, but the western form referred to this species is quite different in a number of characters and I believe it should all be referred to *E. stoloniferum* (Hook). The only western specimen examined that seemed at all doubtful was from Guadalupe Island, Lower California, collected by Edward Palmer (no. 115) in 1875. The circumstances were such that the accuracy of this label is doubted.

An exceedingly variable species especially in leaf characters ; var. *filescens* Ren. & Card. is a slender form with branches often flagelliform. For the distinctions between this species and *E. stoloniferum* see notes under that species.

9. EURHYNCHIUM STOLONIFERUM (Hook.) Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876–77 : 347. 1878.

Hypnum stoloniferum Hook. Musc. Exot. **1** : *pl. 74.* 1818.
Isothecium stoloniferum Brid. Bry. Univ. **2** : 371. 1827.

Hypnum myosuroides stoloniferum C. Muell. Syn. **2**: 500. 1851.
Hypnum spiculiferum Mitt. Journ. Linn. Soc. **8**: 34. 1865.
Hypnum acuticuspis Mitt. l. c.
Isothecium pleurozoides Kindb. Can. Rec. Sci. 1894: 19. 1894.
Isothecium obtusatulum Kindb. Can. Rec. Sci. 1894: 19. 1894. (Roell 117, Vancouver). *Fide* Cardot, Rev. Bryol. **35**: 310. 1896.

Gametophyte in wide, soft, loosely intricate tufts, light green to brownish green, often glossy; primary stems slender, long-creeping, radiculose, furnished with minute distant leaves; secondary stems dendroid, suberect, 5 cm. or more long, very much branched; branches two or three times divided, of varying length, often long-flagelliform, branches and branchlets inclined to one side; branch leaves varying greatly in habit, spreading to loosely imbricate when dry, sometimes subsecund, 1.5–2 × 0.3–0.4 mm., oblong-lanceolate to ovate-lanceolate, acuminate with point often twisted to the right, serrulate below, coarsely serrate above, smooth or papillose on the back by the thickened angles of the cell walls, margins often slightly revolute below; costa extending to the middle or beyond, often ending in a spine on the back; median leaf-cells linear, rather thick-walled, 7–10: 1; alar cells round-quadrate, incrassate and indistinct; apical leaves of branchlets attenuate; leaves of creeping stems scale-like, 0.7 mm. long, narrowly acuminate, subdenticulate, costate to the middle; leaves of erect stems like those of creeping stems only larger with costa sometimes forking, gradually enlarged and elongated above where they approach the branch leaves in shape and size; leaves of the flagellae distant, slender, lanceolate, often very long-acuminate, serrate: dioicous; the inner perichaetial leaves with broad sheathing bases and long-acuminate squarrose apices, serrate above or nearly entire; costa thin, sometimes wanting; paraphyses very numerous, long, composed of two or more rows of cells at base. *Sporophyte* much as in *E. myosuroides;* capsule ovoid, 2–2.5 mm. long, 2.5–3.1.

Type locality, western part of western North America; Menzies, 1787.

On the ground, trees, and rocks in woods. Apparently common on the Pacific coast. Alaska, Miss Cooley; Colorado, Shockley.

ILLUSTRATIONS. Brid. *l. c.*; Hook. *l. c.*

EXSICCATI. Macoun Can. Musc. 292 in part, 291 (*Isothecium myosuroides*), 293 (*Hypnum spiculiferum*), 656 (*Isothecium pleurozoides*).

An exceedingly variable and perplexing species. The papillose character of the leaves is of no value whatever as a distinction, as the leaves of European *E. myosuroides* are frequently papillose and this character varies even on leaves of the same plant. I have seen type specimens of *Hypnum acuticuspis* Mitt. and *Hypnum spiculiferum* Mitt. The specimens of *H. spiculiferum* were larger and had larger, longer acuminate, more strongly acuminate leaves on the secondary stems than is usually the case with *E. stoloniferum*, but there were two well developed cilia with rudiments of a third. It appears to be a well-developed form of *E. stoloniferum*. *Isothecium pleurozoides* is a broad leaved form varying in the direction of var. *myurcellum*.

E. stoloniferum differs from *E. myosuroides* in its larger size, more frequent and better developed flagellate branches, in the longer branch leaves with a broader and more gradually narrowed acumination, and broader and longer median cells. The stem leaves also are slightly rounded at the basal angles, as broad as long and narrowed to a comparatively long slender acumination.

9a. EURHYNCHIUM STOLONIFERUM CARDOTI (Kindb.).

Isothecium Cardoti Kindb. Bull. Torr. Bot. Club, **17**: 278. 1890.

Bright glossy yellow-green; secondary stems irregularly pinnately branching, 5–10 cm. long, sometimes bearing long rigid flagellae at the ends; branch leaves reaching 3 mm. in length by 0.7 mm. in breadth.

A beautiful variety representing the maximum development of the species. So large and striking is it in appearance that at first sight one feels that it must surely be a distinct species, but there is a whole chain of common and intermediate forms. The species itself is one of the most variable species known to me, thus making it impossible to base a distinct species on a form whose principal difference is mere size. It is possible that *E. stoloniferum* itself should be regarded as a subspecies of *E. myosuroides*, but some specific lines seems imperative between such divergent forms as the European *E. myosuroides* and *Isothecium Cardoti* Kindb.

Type locality, Hastings, B. C. On base of trees and logs. Victoria, Vancouver Id.; Washington.

EXSICCATI. Macoun, Can. Musc. 394.

9b. EURHYNCHIUM STOLONIFERUM MYURCELLUM (Kindb.).

Isothecium myurcellum Kindb. *l. c.*

Branches seldom flagelliform, having a much smoother subjulaceous appearance due to the shorter, more appressed leaves; branch leaves ovate-lanceolate to ovate-elliptical, obtusely acute to short-acuminate, 1–1.2 × 0.3–0.4 mm., coarsely, often doubly, serrate above, concave; median cells 5–7 : 1, the upper shorter and broader; apical cells rhombic-elliptical, 2–3 : 1; round-quadrate alar cells more numerous.

On stones and decaying logs.

Type from Victoria and Nanaimo Rivers, Vancouver Island.

Colorado, Shockley; Vancouver Island, Macoun; Marin and Sonoma Counties, California, M. A. Howe.

EXSICCATI. Macoun, Can. Musc. 397, and 292 in part.

By reason of its habit and short pointed branch leaves with well differentiated apical cells, this variety also seems a good species at first sight, but all the intermediate forms of leaves can frequently be found in the same tuft and sometimes even on the same plant.

DOUBTFUL SPECIES.

EURHYNCHIUM DAWSONII Kindb. Bull. Torr. Bot. Club, **17**: 278. 1890.

Gametophyte in thin intricate mats, dirty green, branches tipped with bright somewhat glossy green leaves; branch leaves loosely intricate, slightly or not at all decurrent, ovate, more or less long-acuminate, concave, serrulate above, margins slightly reflexed at base, 1–1.2 × 0.5 mm.; costa very stout, extending four-fifths length of leaf; median cells oblong-linear, 6–8 : 1; area of quadrate alar cells large. Sporophyte not seen.

Described from a specimen bearing this label, "On stones in ditch west side of Black's Hotel, Hastings B. C., April 29, 1889."

Resembling *E. crassinervum* in the stout costa, broad leaf-cells and numerous quadrate alar cells; differing in the slender habit and smaller ovate branch leaves.

The following is the original description:

"Stems densely pinnate, not or rarely radiculose; branchlets patent. Leaves green or brownish, not glossy, not or indistinctly papillose, not long-acuminate from the broad ovate base, recurved on the borders below, long-decurrent, open-erect, denticulate all

around, areolation variable, often sub-rhomboidal; costa thick, reaching nearly to the apex. Probably dioicious."

"Allied to *E. hians* and *E. Sullivantii*."

"On rocks along the Nanaimo River below the railway bridge, Nanaimo, Vancouver Island, April 27, 1887."

EURHYNCHIUM PSEUDO-VELUTINOIDES Kindb. Rev. Bryol. **22**: 84. 1895.

"Leaves not or slightly striate, distant, subulate-acuminate and filiform pointed, faintly reflexed near the base. Stem leaves subobovate or ovate-oblong, entire; costa scarcely reaching to the middle. Branch leaves ovate-lanceolate, denticulate all around; costa reaching somewhat above the middle. Perichaetial leaves with a very long filiform point. Capsules not found: pedicel rough. Tufts loose and green. Stems pinnate, not creeping. Leaves patent or spreading when dry. Probably monoecious."

"Canada, Vancouver Island, earth (1893): Macoun."

No specimens available and original description quoted.

EURHYNCHIUM CRASSINERVIUM (Tayl.) Br. & Sch. var. LAXORETE Kindb. Macoun, Cat. Can. Pl. **6**: 207. 1892.

"Differs in the leaves being nearly entire or faintly denticulate above, shorter acuminate and the cells larger. Only male flowers found."

"On earth in woods at Canaan Forks, Queen county, New Brunswick. J. Moser."

No specimens available and original description quoted.

EXCLUDED SPECIES.

Eurhynchium subintegrifolium Kindb. Ottawa Nat. **7**: 21. 1893.

Specimens from "earthy banks by the sea, Comox, Vancouver Island, no. 146b (sterile); coll. J. Macoun" have the costa short and double and certainly are not referrable to this genus.

Eurhynchium pseudo-serrulatum Kindb. Ottawa Nat. **7**: 22. 1893. = *Brachythecium Starkei.*

Eurhynchium semiasperum C. M. & Kindb. Macoun Cat. Can. Pl. 6: 207. 1892. = *Brachythecium plumosum.*

The remainder of Kindberg's new species of *Eurhynchium* be-

long, according to his own classification, to groups that are not here included in *Eurhynchium*.

Eurhynchium colpophyllum Sulliv. is a *Scleropodium*, *S. colpophyllum* (Sulliv.).

Hypnum lentum Mitt. appears to be a *Scleropodium* also, *S. lentum* (Mitt.).

About *Hypnum apocladum* Mitt. nothing further is known and it is doubtful to what genus it should be referred.

Hypnum Brewerianum Lesq. certainly does not belong in *Eurhynchium*.

Hypnum aggregatum Mitt. is a synonym for *H. Brewerianum* Lesq.

Isothecium Howei Kindb. Rev. Bryol. **22**: 82. 1895, is probably nothing but a variety of *H. Brewerianum*.

New Plants from New Mexico.—I.

By E. O. Wooton.

A portion of the summer of 1897 was spent by my wife and myself in central southern New Mexico collecting plants. Between June 14 and September 10 we traveled in a wagon from Mesilla nearly to Fort Stanton and back, camping wherever it was most convenient and collecting as we went. The country visited is interesting botanically and a part of it has, so far as I know, never been visited by any botanist except myself.

The Mesilla Valley, in which now lie Las Cruces ("Crucis") Mesilla, Doña Ana and the ruins of old Fort Fillmore referred to in the Botany of the Mexican Boundary Survey, is but a broadening of the flood plain of the Rio Grande; it is partly under cultivation and is composed partly of flats of more or less alkaline adobe soil and partly of low sand hills.

Twelve miles east of the valley and running nearly parallel to it are the Organ Mountains visited in the early fifties by Mr. Charles Wright and Dr. Bigelow. This range of mountains is narrow, rugged and precipitous, with little water and comparatively few trees.

East of the Organs (and their northern extension, the San Andreas Mountains) lies an almost flat plain, fifty to sixty miles wide and bounded on the eastern side by the Sacramento and White Mountains. This plain is a treeless and apparently barren stretch of mesa, lowest near the middle, where the altitude is about 4000 feet above the sea level.

The only water is very strongly alkaline and is found at three wells near the middle of the plain and a few miles south of a very peculiar and extensive deposit of gypsum known as the "White Sands."

The White Mountains are in Lincoln County almost due northeast of the Organs and about ninety miles away. They cover several hundred square miles of area, receive considerable infall, are watered by several small streams, have heavy forests

of pine and Douglas spruce with a sprinkling of oaks and a very interesting herbaceous flora.

Of the whole time in the field nearly one month was spent in and about Mesilla, about two weeks in the Organ Mountains, nearly one week at the White Sands and the remainder at various places in the White Mountains from Tularosa, at the southwestern base of the range, to the Mescalero Indian Agency, Ruidoso Postoffice, Gilmore's Ranch on Eagle Creek, and finally to the top of Sierra Blanca Peak.

The result of the trip was the collection of numerous interesting and not a few rare plants, while the following are some of the new species discovered:

LEPIDIUM EASTWOODIAE.

Perennial with ligneous base from which arise one to several erect stems 6–10 dm. high, which branch corymbosely at the top; branches terminated by many-flowered racemes: basal and lower stem leaves 3–5 cm. long, pinnately divided into oblong acute segments which are entire or few-toothed, upper cauline leaves narrowly oblong-lanceolate, acute, entire or occasionally with a few lobe-like teeth, 2–6 cm. long and 2–8 mm. broad, not revolute, all leaves thin, dark green and glabrous: rachis and pedicels pulverulent; pedicels in fruit 5–7 mm. long, spreading, about 2 mm. apart on the rachis; flowers bright white, crowded in a rounded cluster at the top of the raceme: sepals elliptic, 1 mm. long, greenish white, glabrous, deciduous before the petals: petals elliptic, 3 mm. long, claw 1 mm. long: stamens tetradynamous: pod elliptic-ovate, emarginate, tipped by the style which is scarcely longer than the emargination.

Described from plants collected at the Mescalero Agency in the White Mountains, Lincoln County, July 26, at an altitude of 6300 feet.* No. 672.

I became acquainted with this plant in the fall of 1890 when I collected it at the Organ Mountains. I have named it in honor of Miss Alice Eastwood, curator of the Herbarium of the California Academy of Science, who first called my attention to the fact that it was probably distinct from *L. alyssoides* Gray.

This plant is most nearly related to *L. alyssoides*, from which it

* The altitudes here given are from uncorrected aneroid readings and have a possible error of 150 feet or less.

is difficult to separate it without the best of dried material. The characters which are of most importance are its size and habit, and thinner darker green foliage, the cauline leaves being much broader and the pinnatifid leaves being more numerous and not wholly basal. Normally it grows in rather heavy soil producing erect simple stems 5–8 dm. to the first branch. Plants of the first year produce but a single stem and might easily be taken for annuals.

In the Organ Mountains old plants are quite frequently found growing in cracks in vertical cliffs, and in these situations the stems grow out at all angles and curve upward. I have seen well grown plants of this kind forming hemispherical masses of green and white a meter in diameter upon the face of a perpendicular rocky wall.

LEPIDIUM THURBERI.

Annual (?) corymbosely much branched from near the base up the stout central erect stem, 3–4 dm. high; stems and leaves villous-hirsute with coarse white hairs, which are very numerous upon the young parts: leaves all pinnatified, segments ovate to oblong-elliptic, acute, entire or variously toothed in the lower leaves: inflorescence of numerous corymbosely arranged many-flowered racemes, 2 dm. or less long; flowers bright white, crowded at the top of the rachis; pedicels in fruit 5 mm. long, ascending: sepals ovate, concave, 1.5 mm. long, glabrous, green with white margin: petals elliptical, 2–3 mm. long, short-clawed: stamens tetradynamous, filaments subulate, 2–3 mm. long, anthers elliptical: pod elliptical to rotund, glabrous, emarginate, tipped by the scarcely 1 mm. long style.

Collected at Lava, June 11, while passing through on the train. No. 672.

Alt. 4200 ft.?

First collected by Dr. Geo. Thurber, at the copper mines, near what is now Silver City, in 1851 (no. 323), for whom it is here named. Also collected by Dr. H. H. Rusby, near Prescott, Ariz., May 18, 1883, and by Dr. T. E. Wilcox, at Fort Huachuca, Oct. 1892.

This plant has until now been included in *L. montanum* Nutt. which is caespitose, "nearly glabrous, decumbent" and has its upper leaves entire and comes from the extreme northwestern part of the United States.

LESQUERELLA AUREA.

Annual, sending up several erect or slightly spreading stems 3–4 dm. high, each terminating in a raceme of bright yellow flowers: leaves narrowly obovate to oblanceolate, 1–3 cm. long, 3–10 mm. broad, upper ones oblong, decurrent, subsessile, obtuse, entire to slightly sinuate-dentate; leaves, stems and outside of sepals covered with a close fine soft stellate pubescence, tomentulose on the younger parts of the inflorescence: flowers in terminal racemes, crowded at the end of the rachis, the latter elongating in fruit; proper peduncle about 1 cm. long, rachis (in specimens which have only a few mature pods) 1 dm. long; pedicels 3–6 mm. long in flower, ascending, 10–12 mm. long in fruit, strongly recurved: sepals oblong, obtuse, 3 mm. long, yellowish: petals obovate-spatulate, 5 mm. long, half as broad, blade decurrent into a kind of winged claw: filaments subulate, anthers sagittate: ovary glabrous, containing 3–8 pendulous ovules: pod globose, 3 mm. in diameter, not stipitate, glabrous, tipped by the 2–3 mm. long persistent style; seeds 2–5 ovoid, light brown.

Collected on the south fork of Tularosa Creek three miles east of the Mescalero Agency in the White Mountains at an altitude of about 6500 feet on hillsides, July 30. No. 245.

This species is properly classed in the same group with *L. recurvata* (Engelm.) Wats. and should follow that species, being somewhat intermediate between it and *L. Lindheimeri* (Gray) Wats. It is easily distinguished from the latter by its strongly recurved fruiting pedicels, its less dentate leaves, slender stems, smaller flowers and softer, not lepidote pubescence. From *L. recurvata* it is separated by stouter, erect, simple (?) stems (the stems in my specimens are not branched but short branches are beginning to appear in the upper axils, indicating that they may branch somewhat as in *L. recurvata*) much larger leaves, terminally clustered and more numerous flowers and the peculiar soft pubescence which is not lepidote or scabrous.

MENTZELIA PERENNIS.

Perennial; stems caespitose, erect or slightly spreading, branched above, scabrous with retrorsely barbed hairs or almost glabrous, bark thin and white: leaves alternate, linear, 3–10 cm. long, 2–3 mm. wide, entire or with 10 or less, rounded tooth-like lobes, 2–5 mm. long, scabrous with barbed hairs: flowers terminal or in the upper axils producing a pseudo-cymose inflorescence; peduncles

about 1 cm. long, subtended by small leafy bracts: calyx-tube turbinate, 5 mm. long, limb of 5 subulate segments 1 cm. long, scabrous, an indurated ring forming at the base of the segments: petals 10, oblanceolate, acute, entire, light lemon-yellow, 2 cm. long, the outer five 5 mm. broad, the inner a little narrower: stamens numerous, five outer filaments slightly expanded, same length as petals, inner ones shorter: style 1 cm. long; stigma 3-parted, minutely ciliate: pod campanulate-cylindric, barely 1 cm. long, 4 mm. in diam. when nature, with persistent calyx-lobes variously arranged, scabrous, placentae 3, parietal, strongly horizontaly laminated; seeds numerous, flattened elliptic-orbicular, winged.

Collected in a white soil (strongly impregnated with gypsum?) at Round Mountain, half way from Tularosa to the Mescalero Agency in the White mountains. July 21. Altitude 5400 feet. No. 184.

This species belongs to the group containing *M. multiflora* (Nutt.) Gray and *M. pumila* T. & G., and is, judging from the description of that species, closely related to *M. densa* Greene, but distinct from it as Prof. Greene assured me when shown my specimens.

MENTZELIA RUSBYI.

Erect, annual (?) 1–1.5 m. high, branched above: stem stout, scabrous, becoming glabrous, white: lower leaves long-lanceolate, 2 dm. long or less, 15 mm. wide, attenuate into a petiole, upper ones oblong-lanceolate, 4–10 cm. long, 1–2 cm. broad, sessile, acuminate, sinuate-dentate with a few large sharp teeth, very rough with barbed hairs: flowers in terminal cymes: calyx-tube clavate, 8–10 mm. long, bearing two pinnatifid bracts at its base; segments of the limb narrowly lanceolate, acuminate, 10–12 mm. long, 3 mm. broad at base: petals 10, light yellow, the outer five narrowly obovate to oblanceolate, 16–20 mm. long, 4–6 mm. broad, acutish, the inner five a little narrower and shorter, and tipped with rudimentary anthers: stamen numerous, 6–12 mm. long, a few of the outer filaments slightly detailed: style 1 cm. long; stigma 3 cleft: capsule clavate-cylindric, 3 cm. long, 1 cm. in diameter, striate, scabrous; seeds numerous, flattened, ovate, winged.

Collected at the Mescalero Agency in the White Mountains July 26, at an altitude of 6300 ft., no. 210. First collected by Dr. H. H. Rusby at Bellmont, Ariz., September 2, 1883 (no. 614), for whom the species is here named.

Its affiliations are with *M. Wrightii* Gray, from which it can

be separated by its larger size, larger leaves which are sharply toothed and not at all pinnatifid, and by the much larger flowers, and *M. nuda* (Pursh) T. & G., which has smaller, more finely toothed leaves and still larger flowers.

CONANTHUS (?) CARNOSUS.

Perennial root; stems several and much branched forming a rounded mass 3–4 dm. high, fleshy (shriveling much on drying) canescent with matted more or less appressed stiff white hairs; leaves linear, 2–4 cm. long, 1–2 mm. broad, fleshy and so strongly revolute as to appear terete, obtuse, strongly hispid; whole plant of a peculiar yellowish green color not shown in the dried material: inflorescence cymose, pedicels 2–3 mm. long, each flower subtended by a linear leaf-like bract: sepals linear, obtuse, 7–10 mm. long, hispid, little united at the base, persistent: corolla ochroleucus, tubular, slightly exceeding the sepals, constricted at the throat, pubescent; limb of five strongly reflexed oval repand segments, 1–2 mm. longer, throat not personate, glabrous: stamens 5, alternate with corolla lobes, filaments inserted at slightly different heights on the tube, each decurrent into two wing-like margins at the base, which are not free at the tips as in *Phacelia;* anthers ovate, included: styles two, free their entire length, peristent, spreading, villous at the base; stigmas capitate; ovary two-celled by the intrusion of the placenta which is thickened and pseudo-central, but breaks away with the two valves; disk not very prominent: pod oblong-ovate, pubescent; seeds numerous (about 50) horizontal, irregular from crowding, brown, reticulate pitted under high power.

Collected on the White Sands July 17. Altitude 4000 feet. No. 164.

This plant is most nearly related to *Nama stenophyllum* Gray, with which, however, it will hardly be confused. As to whether it should be called *Conanthus* or *Marilaunidium* I am not at present able to decide, having nothing but a description of the former genus at hand.

VERBENA PERENNIS.

Suffrutescent perennial, 3–4 dm. high, with numerous erect or ascending striate-angled stems: leaves linear, the lowermost occasionally pinnately few-lobed, 1–2.5 cm. long, 2–3 mm. wide, erect or ascending, entire, margins revolute; leaves and stems sparsely covered with short sharp stiff upwardly-pointing hairs: spikes terminating the stems and branches, loosely many-flowered; flowers small, 7–8 mm. long, sessile, each subtended by an ovate

persistent bract 3 mm. long and glabrous above: calyx 4 mm. long, tubular, herbaceous ribbed, ribs pubescent, hyaline and glabrous between the ribs, teeth short-triangular, equal, acute: corolla deep blue, tube slightly longer than the calyx, expanded just below the throat, forming a ring in which the almost sessile anthers lie, throat filled with hairs; the limb 5-parted, bilabiate, lobes elliptical, repand: style short, included, stigma unequally two-lobed, clavate: fruit four cylindric glabrous reticulated brownish nutlets, minutely retrorsely scabrous on the commissure, enclosed in the persistent calyx, 5–7 mm. apart on the rachis.

Found growing in crevices of rocks along the road about two miles west of the Mescalero Agency in the White Mountains, July 21. Altitude 6000 feet. No. 187.

This species is most nearly related to *V. canescens* H.B.K. var. *Neo-Mexicana* Gray, but may be easily separated from that variety (?) by the linear, generally simple revolute leaves and the peculiar pubescence.

MONARDA STRICTA.

Aromatic perennial: stems erect, little or not at all branched, quadrangular with rounded angles, reddish tinged, 5–8 dm. high, standing alone or in clumps arising from creeping underground stems, internodes generally longer than the leaves: leaves opposite on petioles 1 cm. long or less, ovate- to triangular-lanceolate, 4–6 cm. long, 1–2 cm. wide, acuminate, a few sharp serrate-dentate teeth along the sides but the acumination entire, base rounded or truncate, not cordate; whole plant canescent with minute curved hairs, glabrate upon the upper surface of the leaves which is slightly darker green: flowers in a single terminal involucrate head, short pedicelled: bracts of the involucre leaf-like, elliptic-ovate, short-acuminate, rose purple above, 1–2.5 cm. long, floral bracts linear-subulate, hispid on margins: calyx tubular, 13-ribbed, 7–10 mm. long, limb of five equal subulate teeth 1–2 mm. long, throat densely white or purplish hirsute within, a tuft of stiff spreading hairs in each sinus of the limb: corolla bright purple, becoming bluer with age, strongly bilabiate, upper lip linear, straight, lower lip 3-lobed, lateral lobes broad, repand, middle lobe oblong, entire corolla except the middle lower lobe villous on the outside, upper lip not more so at the tip: stamens two, exserted with pistil from under the upper lip: ovary with 4 rounded lobes, glabrous; mature fruit not seen.

Collected on the divide, nine miles northeast of the Mescalero Agency in the White Mts., August 1. Alt. 7000 ft. No. 267.

This is *M. fistulosa* L. var. *mollis* (L.) (Mearns no. 86. Mogollon Mts. Ariz., July 13, 1897) of Britton in N. Y. Acad. Sci. **8**: 71. 1889, Not Benth.; and Heller's no. 3798, distributed as *M. Lindheimeri* Engelm. & Gray, from near Santa Fé, N. Mex., July 2, 1897. Alt. 8000 ft. It was collected by Mrs. R. W. Hoyt at Ft. Apache, Ariz., in 1893 (*M. scabra* Britton *l. c.* **14**: 40. 1894. Not Beck.), and by myself in the White Mts., N. Mex., at about 6800 ft., July 3, 1895.

It has passed as *M. scabra* Beck, to which it is most closely related. It may be distinguished by its darker colored flowers, its strict unbranched stem, its longer internodes and generally narrower not cordate leaves.

New Plants from Western North America.—II.

By A. A. Heller.

Thelypodium sagittatum (Nutt.).

Streptanthus sagittatus Nutt. Journ. Acad. Phila. **7**: 12. 1834.
Thelypodium Nuttallii Wats. Bot. King Exped. 26. 1871.

Dr. Watson recognized the fact that the specific name *sagittatum* could not be used for two different species in the genus *Thelypodium*, but unfortunately he gave a new specific name to the older plant, and kept up the name of *sagittatum* for the later published *Pachypodium sagittatum* Nutt. On page 26 of the King Expedition Report, he says the plant was "Collected by Nuttall in Southern Idaho," a statement which does not seem to be borne out by the fact, for the paper in which this species is described, is entitled "A Catalogue of a Collection of Plants made chiefly in the Valleys of the Rocky Mountains or Northern Andes, towards the sources of the Columbia River, by Mr. Nathaniel B. Wyeth, and described by T. Nuttall."

Thelypodium torulosum.

Pachypodium sagittatum Nutt.; T. & G. Fl. N. A. **1**: 97. 1838.
Thelypodium sagittatum Endl.; Walp. Rep. Bot. **1**: 172. 1842.

As stated above, this is the species to which Watson should have applied a new specific name, instead of giving it to the earlier published species. The original locality of this species is "Plains on the west side of the Rocky Mountains." I have given it the specific name *torulosum*, in reference to the torulose pod.

Lupinus Hellerae.

Perennial; stems several, growing in clusters from a stout rootstalk, erect, 3–3.5 cm. high, sericeous, as are also the petioles and both sides of the leaflets, or the hairs on the lower part of the stem and petioles somewhat spreading; leaves numerous, basal, or the flowering stem bearing one or two; petioles 10 to 15 cm. long, their bases dilated; leaflets seven to nine in number, usually eight, oblong-lanceolate, with tapering base, 4–4.5 cm. long, 5 mm. wide when mature, the apex acutish and mucronate, mid-vein yellowish, prominent beneath; stipules narrowly

linear-lanceolate, about 7 mm. long; flower stalks scapose, the flower bearing part 15 cm. long; flowers rather large, deep indigo blue, 1 cm. in width, and nearly 1.5 cm. long, verticillate, the internodes usually short; bracts narrowly lanceolate, barely half the length of the calyx; calyx sericeous, not spurred, not quite half the length of the corolla, unequally cleft, the upper lobe slightly shorter, and again two-cleft, its lobes obliquely lanceolate; the lower lobe lanceolate, entire, strongly concave; banner glabrous, bearing a light spot on the inner face, keel bearded on the inner side near the apex.

The type is no. 3080, collected opposite the Central Ferry, four miles east of Lewiston, Nez Perces county, Idaho, May 18, 1896, altitude 800 feet. The specimens were obtained in low, sandy and gravelly ground, on the banks of the Clearwater river, formerly known as the "Kooskoosky," where it grew in large patches, the hundreds of plants, with their bright blue flowers, presenting a very attractive appearance. It is with pleasure that I dedicate this beautiful species to my wife, Mrs. E. Gertrude Heller, who assisted in gathering the specimens.

This species was collected by Sandberg, MacDougal and Heller in 1892, at a point four miles further up the river, where it grew on an island, in sand and gravel near the water's edge. It is their no. 120, determined as "*Lupinus lepidus* Dougl." by Mr. Holzinger, in Cont. U. S. Nat. Herb. **3**: 219. An albino form was also collected at the same time, growing in company with plants of ordinary color. Mr. Holzinger also gives the wrong habitat, for he says, "On Peter creek near Upper Ferry, Clearwater river, above Lewiston." It may be stated that the habitat which he gives to no. 120 belongs to no. 99, and the "island in Clearwater river" under no. 99, belongs to no. 120, but not the "grassy hillsides," for the islands are almost level. Also, no. 99 is not "*Lupinus Burkei* Wats." as determined by him, but is *Lupinus Wyethii*. In 1892 it was collected by the writer on hillsides along Peter creek, and again in 1896 in similar situations along the Clearwater river.

Lupinus Hellerae is, perhaps, common along the Clearwater, but I have seen it only at the two places mentioned, and nothing like it seems to be in any of the herbaria, so far as I know. It is related to *L. lepidus* in a general way, but very distinct, as is appa-

rent by referring to the original description and the accompanying plate in the Botanical Register.

HYDROPHYLLUM ALBIFRONS.

Hydrophyllum Virginianum Holzinger, Cont. U. S. Nat. Herb. **3**:241. 1895. Not L.

Perennial; stem moderately stout, 4–6 cm. high, more or less hirsute; leaves all on stout petioles, those of the root leaves dilated at the base, slightly clasping, those of the stem confluent with it for a considerable distance, the blade 10–16 cm. long, 10–12 cm. wide; leaflets in three or four subopposite pairs, exclusive of the three-lobed terminal segment, more or less decurrent, ovate-lanceolate in outline, acute, usually two-lobed, and coarsely serrate, light green when fresh, hirsute above with appressed hairs, clothed beneath with soft white short hairs; inflorescence equalling or slightly exceeding the subtending leaf; peduncles stout, grooved, densely wooly, cymes compact: calyx half the length of the petals, very pubescent, parted almost to the base, the lobes linear-lanceolate, acute, heavily fringed with long white wavy hairs: corolla cream-colored, or faintly tinged with purple, about 1 cm. long, puberulent, especially on the lower half, the lobes broadly oblong, obtuse, notched.

The type is no. 3269, collected June 20, 1896, in the woods at the head of Lake Waha, Nez Perces county, Idaho, altitude 2000 feet. Several dozen plants were growing in an open, grassy place near a stream. The white appearance of the leaves is somewhat lost in dried specimens, but is conspicuous in the living plant.

No. 112 of Sandberg, MacDougal and Heller, wrongly referred to *H. Virginianum*, by Mr. Holzinger, belongs to this species. These specimens were collected by the writer at two stations, in the Clearwater valley, once on the banks of Peter creek, under a clump of willows, and again in similar situations along the Lapwai.

To this species are also referred two specimens from the State of Washington. One was collected at Pullman, May 31, 1893, no. 1697, by Prof. C. V. Piper, and labeled "*Hydrophyllum occidentale*." The other was collected by Sandberg and Leiberg at Stevens Pass, August, 1893, labeled "*Hydrophyllum Virginianum*." The leaflets in these specimens from Washington are longer and sharper than are those of the type specimen.

CASTILLEJA LUTEA.

Perennial, clothed throughout with lanate pubescence; stems clustered, 20–30 cm. high: basal and lower stem leaves lanceolate, narrow, those of the upper part of the stem oblong, or somewhat obovate, the upper half, or third, usually three-lobed, all of the lobes lanceolate, but the lateral ones narrower and acuminate, the middle one usually again three-lobed, with its lateral segments narrower; floral bracts pale yellow, or the tips somewhat purple tinged, more unequally toothed or lobed than the foliage leaves, the terminal segment broad and rounded, the others narrowly lanceolate; calyx oblong, about 3 cm. long, equally cleft before and behind, the lobes about equalling the tube, slightly dilated and notched at the blunt apices; corolla barely exserted, the galega equalling or a trifle shorter than the tube, faintly tinged with purple, or yellow.

The type is no. 3267, collected May 20, 1896, on grassy hillsides near the mouth of the Potlatch river, Nez Perces county, altitude 1200 feet. It is also abundant on the plateau below Lake Waha. It may be looked for in herbaria under the mixture called "*Castilleja parviflora* Bong.," although I have never seen any other specimens. It is found growing with this other species, but can be distinguished from it at a glance. It is a smaller plant than the so-called *parviflora*, and has an entirely different kind of pubescence.

Our specimens somewhat resemble the type of *Euchroma Bradburii* Nutt., preserved in the herbarium of the Academy of Natural Sciences, Philadelphia, but is apparently not the same, so far as can be ascertained from that poorly prepared and fragmentary specimen.

C. lutea may possibly be the same as *C. desertorum* Geyer, published by Hooker as a synonym of *C. hispida*, in Journ. of Bot. and Kew Garden Misc. **5**: 258. 1853, where the following is given: "Prairie plateaus of the Nez Perces Mountains. * * * Except in color, I do not see how these specimens of Mr. Geyer's *C. desertorum* (no. 511) differ from what I consider to be a mere form of *C. hispida* (no. 377); but when living, characters probably manifest themselves."

As he gives no description whatever, and does not even mention the color which is said to be the sole difference, the name is a

nomen nudum and we have no other clue than that of locality. The species apparently has its home on this plateau below Waha, for it is very abundant there.

In the second line from the bottom of page 296 of Vol. 2, Part I., of the Synoptical Flora, occurs this statement: "*E. angustifolia* Nutt., l. c., a low and small-flowered subalpine form; same as *C. desertorum* Geyer." If Dr. Gray actually saw this plant of Geyer's and also Nuttall's there is no ground whatever for supposing that our plant may be identical with Geyer's, for I have seen the type of Nuttall's *Euchroma angustifolia*, and it is very distinct from ours, as is also indicated by his original description in Journ. Acad. Phila. **7**: 46. 1834.

VALERIANA OCCIDENTALIS.

Rootstalk moderately stout, ascending, somewhat branched; roots numerous; stems rather stout, 6–8 dm. high, puberulent, especially below; basal leaves ordinarily about 25 cm. long, elliptical-lanceolate, bluntly pointed, the petioles occupying more than half of the total length; stem leaves on short clasping petioles, which are ciliate on the lowest pair, ovate-lanceolate in outline, the lower ones 10–12 cm. long, and composed of about four pairs of leaflets, these lanceolate and acute, the lowest pair the smallest, while the single terminal leaflet is several times larger than those of the pair next beneath it; inflorescence much elongated, composed of from three to five pairs of opposite branches, the lowest internode about 12 cm. long, the others growing successively shorter; the lowest flower branches subtended by a bract-like leaf, which is parted into three linear-lanceolate lobes, the other flower stalks provided with narrow linear bracts; flower branches approximately as long as the internodes, surmounted by a three-branched cyme, each branch of which is again subdivided into two or three branches, the pedicels slightly pubescent or puberulent; calyx glabrous, the lobes linear-lanceolate, prominently one-nerved; corolla creamy white, short, with barely half its length exserted from the calyx, the tube only half the length of the throat and limb; stigma entire.

The type is no. 2353, collected July 2, 1896, near the western end of the Craig Mountain plateau, above Lake Waha, Nez Perces county, Idaho, altitude 3500 feet. The plants were growing in rich ground in an open place in the woods.

Valeriana occidentalis was probably distributed by me under

the names of *V. sylvatica* or *V. Sitchensis*, and some few perhaps as "*V. montana* n. sp.," for I had intended to adopt the latter name, not knowing at the time that it had already been used in this genus.

ERIOPHYLLUM PEDUNCULATUM.

Stems several, simple, erect from a slender perennial rootstalk, 3–5 cm. high, reddish below, sparingly floccose, leafy; leaves alternate or sub-opposite, oblong-lanceolate, narrowed at the sessile, somewhat clasping base, mature ones 5 cm. long, 1 cm. broad, entire, or undulate-denticulate, acute, the margins incurved on the lower side, which is covered with floccose tomentum, midvein prominent, yellowish, upper side less floccose and sometimes almost glabrous; upper part of stem naked, forming a peduncle 5–15 cm. long; heads nearly 1 cm. high, about 2 cm. across when expanded; involucre lanate, firm and coriaceous, the divisions eight in number, lanceolate, keeled, the short-acuminate tips recurved; ray flowers oblong, orange yellow, about 1 cm. long, 4 mm. wide, three-toothed; disk flowers colored as are the rays, glandular pubescent on the outside, the lobes very short, triangular-lanceolate; anther tips ovate, obtuse; akenes cuneate-linear, glabrous.

The type is our no. 3390, collected in a dry, open place in the woods on the left bank of the Sweetwater, almost opposite the head of Lake Waha, Nez Perces county, Idaho, altitude about 3000 feet. The specimens were obtained along the ditch which leads from the Sweetwater to the lake, and were growing on a steep slope, among grass and small bushes.

This species seems to belong to Gray's section *Trichophyllum* and is probably part of his composite *Eriophyllum caespitosum*, but certainly distinct from any of the forms described by him. It may be part of his *E. caespitosum* var. *leucophyllum*, but does not at all agree with *Bahia leucophylla* of DeCandolle. I have distributed it as "*Eriophyllum integrifolium*," a plant since raised to specific rank by Professor Greene, and as I now understand it, nothing like this species.

ERIGERON CONCINNUS (H. & A.) T. & G. Fl. N. A. **2**: 174. 1841.
Ditasis ? concinna H. & A. Bot. Beechey, 350. 1840.

Our no. 3229, collected on gravelly hillsides along the Clearwater river, near Lewiston, Idaho, seems to me to be typical

Erigeron concinnus. It was first thought to be a new species, and was distributed without specific name. It is not at all like the specimen in the herbarium of Columbia University, which Dr. Torrey seemed to think was *E. concinnus*, neither is it the same as much of the material which passes for this species. A careful inspection of the original description by Hooker & Arnott, convinces me that our Idaho plant is the same as theirs, and in that case the bulk of the so-called *E. concinnus* belongs to some other species, or is still undescribed. The following is the original description of *Ditasis ? concinna* :

"Toto pilis albidis patentissimis canescenti-strigosa, radice perenni collo multicipiti, caulibus erectis gracilibus angulatis ramosis, foliis linearibus basi attenuatis radicalibus sublonge petiolatis, involucri foliolis subulatis albidis dorso viridibus, radii flosculis uniserialibus numerosis anguste linearibus disco duplo longioribus, pappo conformi biserali, serie ext. brevi paleaceo, int. 8–10 setoso."

"Of the genus of this most beautiful plant, we are uncertain. The slender stems, scarcely a span high, the copious foliage, peduncles and involucres, are everywhere hoary with harsh white spreading hairs. The flowers are about the size of a daisy ; the rays bright blue, in the dried plant, and the disk, yellow. The outer pappus consists of five or six lanceolate short palae ; the hairs of the inner row are equal in thickness throughout."

Our specimens are slightly over a "span" in height, as a rule, although not always so, and are covered with a profusion of beautiful, bright blue flowers. They also answer throughout to the above description. The original was collected on the "Snake River, below the Salmon Falls, Snake Country," by Mr. Tolmie. The Salmon Falls are some 250 miles southeast of Lewiston, but apparently in the same basalt formation.

UNIVERSITY OF MINNESOTA,
Minneapolis, Minn.

Heat of Imbibition by Seeds.

By George Macloskie.

The explanation of the production of heat in germinating seeds by destructive metabolism, with the production of carbon dioxide, is only part of the case; and fails at the initial step, where the necessity is greatest. Nor will it suffice to supplement our explanation by suggestions of rising temperature of the atmosphere or of the soil; for in some cases germination has occurred at low temperatures, even at the freezing point of the soil.

A supplementary, or rather a preliminary source of warmth may be found in the discovery by botanists of a physical law, which though not much discussed by either botanists or physicists, seems to have large application to problems that meet us in all branches of investigation. Sachs informs us * that heat is set free when water enters into organized, and, to a smaller extent, unorganized bodies; stating that according to Pfeffer this was first established by Pouillet, and that in 1865 it was confirmed by Jungk and himself. Nägeli's experiment on this consisted of drying flour-starch, so as to deprive it as far as possible of all water, and then immersing some of it in an equal weight of distilled water, which resulted in a rise of 11.6° C. †

Sachs applies to this result Joule's estimate that 0.03° C. indicates a pressure equal to 34.3 atmospheres; hence 11.6° C. will represent many hundreds of atmospheres. (In fact it would represent more than 13,000 atmospheric pressures, an almost incredible estimate.) This calculation enters into Sachs' theory of the ascent of water in stems of trees, because of the high pressure with which it forces its way into fine tissues like the wood-cells: and which he further illustrates by reference to the use of wedges of wood for splitting granite, on the application of water so as to swell them. He accounts for the phenomenon by supposing that

* Lectures on the Physiology of Plants, translated by Vines, 210.

† Theorie der Gärung. Abhand. der Akad. Wissensch. München, 13: 187. 1879.

the water has became compressed within the starch, and suggests that the water first entering the starch undergoes the highest rise of temperature, and therefore the greatest compression. Perhaps the phenomenon is parallel with that of gases entering spongy platinum or charcoal; and there may be partial condensation as well as compression of the imbibed water. Ganot states that the 'humus' is warmed in moist air by the imbibition of vapor, and that plants are thereby benefited. (Ganot's *Physics*, § 482.)

Neither Sachs, nor any other of the physiologists, so far as we know, has applied this discovery to the case of germination. The comparative freedom from water of ripe seeds has been usually explained as a protection from injury by exposure to extremes of heat or cold, but it seems to be also in a certain way a reserve of potential energy to be drawn on at proper time.

In a rude experiment we placed dry peas with water in a bottle, and beside it a 'controul' bottle of water at the same starting temperature. In about an hour the temperature of the first bottle exceeded that of the second; soon the difference reached 1° C., at which it remained for three days, when some of the peas were germinating. In a second experiment we used dry split-peas, devoid of seed-coat, without radicle or plumule, where there could be no germination. They absorbed the water quickly, but, as there was much loss of heat by radiation, they kept at a temperature only 1° C. higher than that of the control bottle; thus for fifteen hours, when they had become saturated, and the temperature fell to that of the other bottle. The difference of 1° C. will not appear insignificant if we reflect that Sachs made out a difference of only 1.5° C. between the temperature of germinating peas and that of the surrounding air. We may expect that the temperature after germination, though produced in a different way, is continuous in amount with the temperature before germination caused by the imbibition of water, and that there is no jolt or gap as to warmth in the transition from the dormant to the active condition of the embryo.

We have not attempted a quantitative estimate of the amount of heat produced. This might be effected by taking the weight of the seeds and the weight of the water, and finding how much ice would be necessary to keep them down to the temperature of the

control bottle during the entire course of imbibition until germination begins. The significant part of the process is that when seeds are well protected from loss of heat, the imbibition-heat becomes cumulative, so as to reach a considerable amount and to be effective in starting the radicle of the young plant. This may help to elucidate the case cited by Uloth (1871) of the germination of seeds in ice. He found seeds of *Acer platanoides* and also of wheat, between blocks of ice in an ice-house, having started to grow and having pushed their roots several inches down into the fissureless ice. His suggestion was that heat may have radiated through the ice. It appears more probable that something like a lighted taper or burning straw may have melted enough of the ice to wet the seeds, that the heat of imbibition thus produced might melt more of the ice, and this cumulatingly react upon the seed, and so on acting and reacting, whilst the ice itself would present an obstacle against the waste of heat by dissipation in other directions. The fact of its not being an isolated case of a single seed is evidence to prove that there must have been some general cause at work.

PRINCETON UNIVERSITY,
March 22, 1898.

New Plants from Wyoming.—II.*

By Aven Nelson.

Thlaspi glaucum (A. Nelson).

Thlaspi alpestre glaucum A. Nelson, First Rep. Fl. Wyo. 84. 1896.

The perennial, basal part of stem freely branched, the several or many herbaceous stems simple, erect or ascending, 1–3 dm. high; root leaves numerous, petioled, from oval to oblong or obovate, entire or obscurely repand-denticulate; cauline leaves deltoid-auriculate or oblong, entire, 10–20 mm. long, smooth or even glaucous; raceme dense in flower, much elongated in fruit (5–15 cm.); sepals greenish, thin, ovate; petals white, spatulate, about 6 mm. long; pods obovate, obtuse or emarginate; pedicels divaricate, 10–14 mm. long.

In 1897 an abundance of material of this form was secured, an examination of which leads me to think that it is worthy of specific rank. Its habitat is sub-alpine in open parks or among open spruce timber. It is separated from *T. alpestre* by its uniformly larger size, numerous stems, numerous and larger stem leaves, longer pedicels and raceme (in fruit), longer, greenish sepals, etc.

Type specimen in Herb. University of Wyoming, no. 4176, Battle Lake, August 16, 1897. Prof. Henderson's no. 2893 from Kendrick, Idaho seems to be nearly the same.

Mentzelia compacta.

Annual, 2–2.5 dm. high, numerously and compactly branched; stems whitish, pubescent, somewhat brittle; leaves numerous, sessile, entire, obtuse, from broadly linear at base to almost oval at summit, generally ovate-oblong, 2–3 cm. long, rough-hirsute, more coarsely and sparsely so above; flowers yellow, small, numerous in compact cymes at the ends of the branches, sessile, about 3 mm. broad; calyx-lobes lanceolate-ovate, shorter than the

* I am under obligations to Dr. Underwood for securing for me the comparison of these plants with specimens in the Columbia Herbarium; and to Mr. P. A. Rydberg, for making such comparison. Mr. Rydberg's well-known familiarity with northwestern plants makes his examination of these particularly satisfactory.

corolla, petals obovate, about 4 mm. long; stamens 15, anthers small, sub-spherical; capsule linear-clavate, 10–13 mm. long, 10–12-seeded; seeds in one compact row, smooth, longitudinally groove-angled, in form from frustra of triangular prisms to rhomboidal cuboids, faces about 1 mm. long.

Observed but once, possibly local or rare; Parkman, Sheridan county, Wyoming, July 22, 1896 ,no. 2454. Type specimen in Herb. University of Wyoming.

GENTIANA ELEGANS.

Annual, 2–3 dm. high, branched from the base, the 2–20 stems simple or nearly so, each stem or branch terminated by a single flower; leaves 3–6 pairs on each stem, appearing crowded toward the base in the many-stemmed specimens, mostly obtuse, the lower petioled, obovate to broadly spatulate, the upper sessile, oblong or narrower; calyx-lobes nearly equal and similar, equalling the tube in length, bearing in the sinus a fringe of short, obscurely glandular hairs: corolla 4–5 cm. long, deep blue with lighter patches or streaks downward, the lobes obovate-oblong, dentate around the summit, fimbriate on the sides: capsule stipitate; style nearly as long as the capsule proper, the stigma sub-orbicular, dentate.

This handsome species is common in the higher mountains of Wyoming at altitudes from 9000 to 10000 feet. Specimens of it have been distributed as "*Gentiana serrata* near var. *holopetala* Gray," as follows: no. 865, Union Pass, Wind River Mountains, August, 1894; nos. 1539, 1725, 1766 from the Medicine Bow Mountains, collections of 1895.

It differs strikingly from *G. serrata* Gunner (*G. detonsa* Rottb.) in its mode of branching, its broader obtuse leaves, in its dentate (not fimbriate) corolla-lobes, in the position of the fringe of hairs in the calyx, which is in the sinus, and not at the base of the lobes, and in its stipitate, styliferous capsule. *G. serrata*, moreover, is of the low, wet grounds of northern stations; *G. elegans* is met with only, so far as my observation goes, in the mountains at almost fixed altitudes. As the foregoing are essential characters it can hardly be united with the var. *holopetala* for again the narrower leaves, the character of the pistil and other points mentioned cut it out. *G. serrata holopetala* seems to be less branched, more slender and belongs to a more western range.

Type specimen in Herb. University of Wyoming, no. 1539, Cummins, July, 1895.

GENTIANA ELEGANS UNICAULIS.

Many of the characters of the species but smaller in every way, 1–2 dm. high, rarely if ever branched, the simple stems bearing 3–5 pairs of mostly obtuse leaves; the lower leaves small, obovate to oblong, the upper pairs longer and somewhat narrower; peduncles comparatively long; corolla-lobes obscurely dentate around the summit, mostly entire at the sides.

This form like the species is of the higher mountains, usually of more alpine stations. It often occurs in large, evenly planted beds, the plants nearly uniform in size.

Type specimens in Herb. University of Wyoming, no. 4173, Battle Lake, Carbon County, Wyo., Aug. 16, 1897.

DOUGLASIA BIFLORA.

Cespitose, the numerous suffrutescent branches crowned with a rosulate cluster of leaves, the dead clusters from previous years persisting and marking the gradually lengthening branches, only the current year's growth above the surface of the gradually elevated mound in which the stems are buried; leaves lanceolate-linear, blunt, 9–12 mm. long, glabrous or nearly so, margins obscurely denticulate, imbricate-clustered; peduncles pubescent, fascicled, 3–5 rising out of the terminal rosette of leaves, 1–3 cm. long; inflorescence a cyme with only the terminal and one lateral flower developed or sometimes only the terminal one, the terminal blossom almost sessile in the two-bracted involucre, pedicel of the lateral one 1 cm. or more in length; calyx campanulate, tube scarious, lobes foliaceous, lanceolate, equalling the tube; corolla-tube as long or longer than the calyx, the lobes nearly equalling the tube, obovate, truncate, emarginate or few-toothed; capsule turbinate-spherical.

Secured but once, about the summits of the Big Horn mountains near Dome Lake, July 18, 1896. Type specimen in Herb. University of Wyoming, no. 2450.

PHACELIA DESERTA.

Stem single, erect from a stout perpendicular perennial root, 1–2 dm. high, densely leafy at base, sparsely so upward, the whole plant canescent with a short close pubescence, obscurely glandular; leaves petioled, narrowly oblong in outline, pinnate, the pinnae nearly oval and crenately toothed, 5–9 pairs which are nearly equal in size; stem branched at the summit giving a short dense paniculate inflorescence of scorpioid cymes; sepals equal, lanceolate-ob-

long; corolla bright blue, turbinate-campanulate, 7 mm. long, lobes equalling or surpassing the tube, lobes rounded, entire; the obliquely vertical lamellae broad and conspicuous, loosely united over the filament; anthers short-oblong; filaments and style conspicuously exserted; style cleft below the middle; ovary oval, pubescent, cells two-ovuled; ovules oblong; mature seeds not at hand.

Distinctively a desert plant, occupying the high, white, dry and barren bluffs known as the Green River shales. It develops early while the moisture from the spring snows make growth possible.

Type specimen in Herb. University of Wyoming, no. 3050, Green River, May 31, 1897.

PHLOX MULTIFLORA.

Suffrutescent as to the caespitose, much branched, prostrate base, the numerous herbaceous stems nearly erect, 6–10 cm. high, the annual branches simple, one-flowered; leaves broadly linear, glabrous, apiculate, 1–2 cm. long, opposite or fascicled; peduncles finely pubescent, 1–3 cm. long; calyx angled by the prominent midrib of the lobes, membranous in the sinus only, lobes linear-apiculate, equalling the tube; tube of the corolla exceeding the calyx, lobes obovate, entire, 1 cm. long; style equalling the calyx.

The affinities of this plant are with the *P. longifolia* group. It has been distributed under no. 182 from Laramie Hills, mostly as *P. longifolia* Nutt., but from which, I now think, it is wholly distinct. Its more caespitose growth, shorter broader leaves, simple branches, less membranous calyx and numerous flowers easily separate it. It is very abundant on the moister slopes and valleys of the Laramie Hills at 8000 to 9000 ft., flowering from late May till late June.

Type specimen in Herb. University of Wyoming, no. 3175, June 16, 1897.

GILIA ATTENUATA (Gray).

Gilia aggregata, var. *attenuata* Gray, Syn. Fl. **2**[1]: 145. 1886.

It seems to me that only lack of sufficient material can justify leaving this as a variety. The points in which this differs from *G. aggregata* need to be emphasized. They are, as pointed out by Dr. Gray, the considerably longer corolla-tube (about 3.5 cm. as against

about 2.5 cm.), the long, gradually-acuminated corolla-lobes, the filiformly-attenuated calyx-lobes, the constant inclusion of both style and stamens (the position of the stigma and of the anthers varies between 5 mm. and 10 mm. below the throat of the tube), and the white corolla (tube somewhat marked with pink).

It may be added that the *G. attenuata* is hoary or villous-pubescent, especially on the branchlets and calyx; the inflorescence much denser; calyx more glandular and the basal leaves green and glabrate. It seems probable that it will be found to belong to considerably higher altitudes than *G. aggregata.*

Excellent specimens were secured at Battle Lake, Carbon Co., at an altitude of about 10000 feet, Aug. 16, 1897, no. 4189.

PENTSTEMON COLLINUS.

Cespitose, the rootstocks much branched and closely matted; stems numerous, unbranched, erect, often wavy rather than strict, 2–3 dm. high, puberulent their whole length, glandular upward; root leaves numerous, entire, clustered on the crowns of the root-stocks, a dull or dead green, glabrous but scarcely smooth, midrib prominent on the lower face, petioles slender, about equalling the blade, blade elliptic-oblong, acute at both ends, 2–3 cm. long; stem leaves sessile or tapering into a marginal petiole, narrow-oblong or spatulate, 2–4 cm. long; upper leaves shorter, lanceolate-linear, passing into the shorter lanceolate bracts; thyrsus strict, interrupted, 5–9 cm. long, the whole inflorescence minutely glandular-puberulent; peduncles 3–5-flowered, the flowers crowded; sepals broadly lanceolate, scarious margined, loosely spreading, one-third as long as the corolla; corolla deep blue, slender-tubular, but slightly inflated upwards, the lobes short, spreading, sparsely hairy in the throat; sterile filament comose on the flattened apex; anthers dehiscent through the junction of the two cells, not explanate.

Its general aspect and floral characters suggest *P. humilus* Nutt. but it may be distinguished by its more caespitose habit, its more compact root system, its rosulate, pointed root leaves, its smaller, more tubular corolla with shorter lobes, the erect, wavy, puberulent stems and more rigid and paler leaves.

Its habitat seems to be the dry, gravelly hilltops in the foothills. Type specimen in Herb. University of Wyoming, no. 2960, Evanston, May 28, 1897.

PENTSTEMON RADICOSUS.

Cespitose, the short rootstocks producing an inordinate number or coarsely fibrous roots which form an almost unbreakable tufted mat; stems numerous, slender, fascicled, strict and erect, forming a dense bunch which crowns the compact, tufted root system, 2–3 dm. high; stems and leaves puberulent, obscurely glandular upward including the inflorescence; root leaves minute, oblanceolate, or none; stem leaves numerous, oblong-linear, very short-petioled or sessile by a narrowed base, 2–4 cm. long, narrower upward and passing into the linear bracts; inflorescence a compact thyrsus of peduncled cymes, 4–8 cm. long; peduncles 8–12 mm. long, about 3-flowered, pedicels very short; sepals broadly lanceolate, somewhat scarious, about one-third the length of the corolla, tips spreading; corolla tubular, dark blue with a lighter streak down the lower side of the tube, 14–18 mm. long, upper part of the tube slightly inflated, bilabiate, the lower lip longer, very sparsely white bearded, lobes entire, rounded, 3–4 mm. long; sterile filament included, straight, slightly flattened toward the apex, the short yellow beard straight, stiff, of nearly uniform length, at right angles to the filament, dense at apex, more sparse downward past the middle; anthers purple, dehiscent through the junction of the cells but not explanate.

A well marked species easily recognized by its compactly bunched stems, its striking root system and its very numerous, small, uniform leaves. Habitat, gravelly hillsides.

Type specimens in Herb. University of Wyoming, no. 2962, Evanston, May 28, 1897; no. 3089, Point of Rocks, June 1, 1897.

PENTSTEMON ARENICOLA.

Perennial from long vertical branched woody rootstocks, from the crown of each branch one to several simple stems, 2–3 dm. high; entire plant glabrous and stem leaves somewhat glaucous; lower leaves petioled, oblanceolate to broadly spatulate; middle stem leaves spatulate, tapering into a margined petiole, 4–5 cm. long; upper stem leaves sessile by a broad base, from narrowly oblong to lanceolate, abruptly acute or apiculate, 3–4 cm. long; inflorescence short, spiciform, leafy below, the upper bracts short, ovate-lanceolate; sepals broadly lanceolate, slightly scarious, one-fourth the length of the corolla-tube; corolla tubular or but slightly inflated upwards, blue, 12–15 mm. long, its lobes oval, spreading, 3 mm. long, naked in the throat; sterile filament equalling the tube, its hooked flattened apex comose, more sparsely hairy down one side for half its length; anthers dehiscent through

the junction of the two cells but the cells hardly confluent, not explanate.

This plant has the habit of *P. coeruleus* Nutt., but is readily distinguished by its broader, shorter leaves; its shorter inflorescence and smaller flowers; its broader, shorter and slightly scarious sepals, etc.

Abundant in the sand dunes in the hill region of the Red Desert, near Point of Rocks. Collected June 1, 1897, at which time it was nearly out of blossom. Type specimen in the Herb. University of Wyoming, no. 3090.

PENTSTEMON RYDBERGII.

Perennial from horizontal rootstocks which give rise at somewhat regular intervals to vertical branches; from the crowns of these spring long slender floriferous stems or very short leafy branches; glabrous throughout, 3–5 dm. high; radical leaves and those on the sterile branches oblong, obtuse, on slender petioles as long as the blade or longer; cauline leaves few, sessile by a broad base, narrowly oblong; the lowest pair of bracts leaf-like, broadly linear; the two or more verticils of the interrupted spike many-flowered, the lower one usually distant; corollas 10–14 mm. long, light blue; sepals scarious, somewhat lacerate-margined.

This beautiful form has enough points in common with *P. confertus* Dougl. to suggest that species which is probably the nearest ally. It was met with in abundance in an aspen grove in a draw in the Laramie Hills, July 1, 1897. Type specimen in Herb. University of Wyoming, no. 3214. I take pleasure in naming this for Mr. P. A. Rydberg, whose generous assistance I have acknowledged on a previous page.

WULFENIA WYOMINGENSIS.

Perennial from a short rootstock, bearing numerous fascicled roots; stems 1–3 from each rootstock, puberulent or softly pubescent, 1–2.5 dm. high; radical leaves petioled, from broadly ovate to oblong, crenate-dentate, rounded or subcordate at base, mostly obtuse at apex, very variable in size, obscurely puberulent; cauline leaves sessile, small, diminishing upward, broadly ovate, mostly acute; bracts broadly lanceolate, narrower toward the apex of the spike, pilose-pubescent; calyx anteriorly cleft to the base, posteriorly into two or three lobes to about the middle, the lobes either entire or (if only two) with two tooth-like lobes; corolla wanting; stamens conspicuous, filaments twice the length of the calyx,

anthers large, the cells slightly divergent below; style equalling the stamens; stigma small, capitate; ovary pilose-pubescent; capsule emarginate, large, turgid, puberulent, protruding from the cleft side of the calyx.

Common in the Laramie Hills at 8000 to 9000 feet where it develops early. It seeks the loose, rich soil of the valleys and slopes among the sage-brush. It has the habit of *W. rubra* (Dougl.) Greene and is easily mistaken for that species. However, the peculiarity of its calyx alone will easily separate it. Distributed by me under the name *Synthyris rubra* Dougl. as nos. 29 and 1242. Type specimens in Herb. University of Wyoming.

WULFENIA GYMNOCARPA.

Perennial from a short rootstock bearing numerous fascicled roots; stems simple, 1–3 from each rootstock, curved ascending, puberulent or soft-pubescent, 1–3 dm. long; radical leaves numerous, petioled, mostly ovate-oblong, rounded at base or rarely subcordate, from coarsely to obscurely crenate-denticulate, glabrate or puberulent; cauline leaves sessile, small, from ovate to oblong-lanceolate, smaller and narrower upward where they pass into the bracts; spike short and crowded, 3–8 cm. long, pilose-pubescent, bracts from broadly lanceolate at base of spike to linear at summit; calyx reduced to three, or more usually to two sepals, these on the posterior side, the anterior face of the pistil being naked; sepals distinct to the base or occasionally united one-third of their length, linear-lanceolate, soft-pubescent; corolla wanting; stamens but little longer than the sepals, apparently often unequal, anthers small, the cells not divaricate: ovary pubescent, style long, equalling the stamens but with the development of the capsule carried out beyond them; capsule orbicular, much flattened at maturity, equalling or longer than the style, naked but for the slender bract and sepals closely approximated on its posterior angle.

Like the preceding, this has the general habit of *W. rubra*. It is with some hesitation that I add two more species in which the corolla is wanting, to the genus *Wulfenia*. But these two certainly lend strength to Dr. Greene's contention * that the number of calyx-lobes cannot in this group be used as a diagnostic character by which to separate *Synthyris* from *Wulfenia*.

Type specimen in Herb. University of Wyoming, no. 2959, from Evanston, May 29, 1897.

* Erythea, May, 1894.

SCUTELLARIA VIRGULATA.

Perennial from slender oblique rootstocks, the nodes of which are often marked by scales; stems puberulent, simple, one or more from the crown of the rootstock, slender, strict or sometimes curved, leafy throughout, 2–3 dm. high; leaves entire, nervose, bright green, puberulent under a lens, nearly sessile; lower stem leaves small or rarely wanting, obovate to oblong, 1–2 cm. long, much shorter than the internode; middle stem leaves oval to oblong, obtuse, about 3 cm. long, equalling the internode; upper stem leaves from oblong to lance-linear, longer than the internodes, appearing crowded, obscurely glandular; flowers blue, borne singly in the axils of the upper pairs of leaves, resinous-puberulent; pedicels about one-half as long as the calyx; calyx green even as to the crest; corolla-tube gradually dilated upward, about 2 cm. long, glabrous in the throat; nutlets minutely tuberculate.

Closely allied to *S. Brittoni* Porter but with slenderer rootstocks, longer, slenderer, more virgate stems and fewer flowers. In *S. Brittoni* the internodes are uniformly shorter than the leaves, in this only the upper leaves exceed the internodes.

In loose soil among the stones on the partly wooded summits of the Laramie Hills at about 9000 feet. Type specimen in the Herb. University of Wyoming, no. 3218, Green Top, June 28, 1897.

RUMEX TUBEROSUS.

Perennial by a horizontal woody rootstock on the under side of which are borne large fascicled, oblong-elliptic tubers; glabrous throughout; stem stout, nearly erect, conspicuously grooved, 2–4 dm. high; leaves large, moderately thick, somewhat crisped on the edges, crowded at the base, smaller and more distant upwards, all petioled, lower oblanceolate-oblong; 10–15 cm. long, 3–5 cm. wide, upper lanceolate; ocreae large and thin; racemes erect; bracts few, leaf-like, lanceolate, seemingly deciduous, the inflorescence at length naked and interrupted; calyx red, conspicuously winged at maturity; pedicels filiform, as long or longer than the wings; wings cordate, 10–13 mm. long, no callosities, deep red, lighter with age; style branches divergent; achene 10 mm. long, smooth with margined angles.

This species seems most closely allied to *R. venosus* Pursh which it simulates in habit. It is, however, a larger plant while the wings of the fruit are smaller. It is strikingly separated from this, and all other species known to the writer by its large tuber-

ous rootstocks. Its habitat also is distinctive, for it was observed only in the most pronounced alkali soils—in the white, friable, ash-like soil, containing 5 to 15 per cent. of salts, found on some porions of the Bitter Creek flats in the Red Desert.

Type specimen in Herb. University of Wyoming, no. 3114, Bitter Creek, June 3, 1897.

A Correction.

ATRIPLEX EREMICOLA. (*Atriplex fruticulosa* G. E. Osterhout, Bull. Torr. Bot. Club, **25**: 207 Ap. 1898. Not *A. fruticulosa* Jepson, Pittonia, **2**: 306, 20 S. 1892.) Since the specific name *fruticulosa* is antedated in this genus, I substitute the above name for the one which I first published.

GEORGE E. OSTERHOUT.

NEW WINDSOR, COLORADO,
April 19, 1898.

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